SCIENTIFIC AMERICAN

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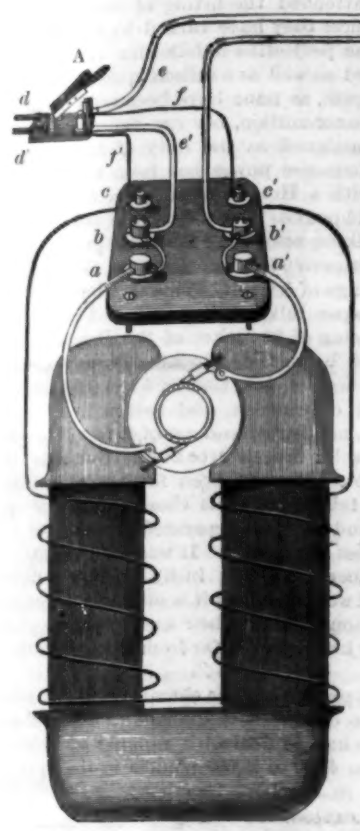


Fig. 4.—MOTOR CONNECTIONS.

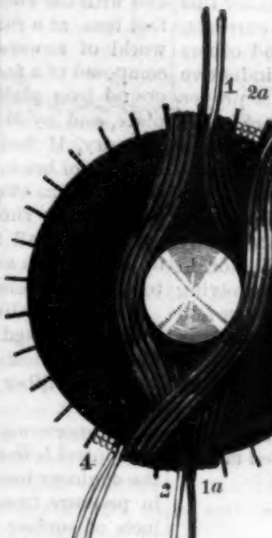


Fig. 2.—BEGINNING OF WINDING.

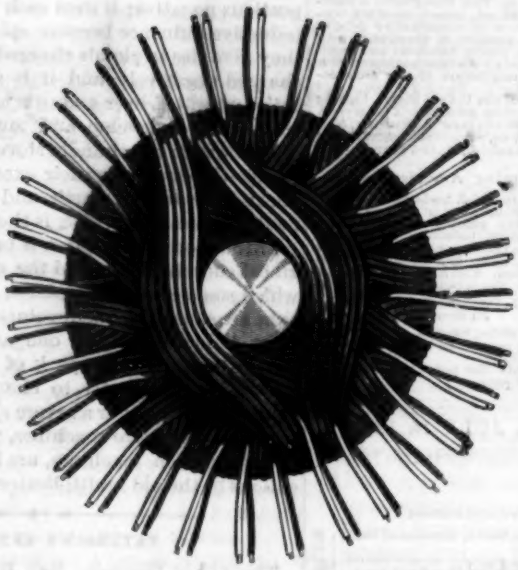


Fig. 3.—END OF WINDING.

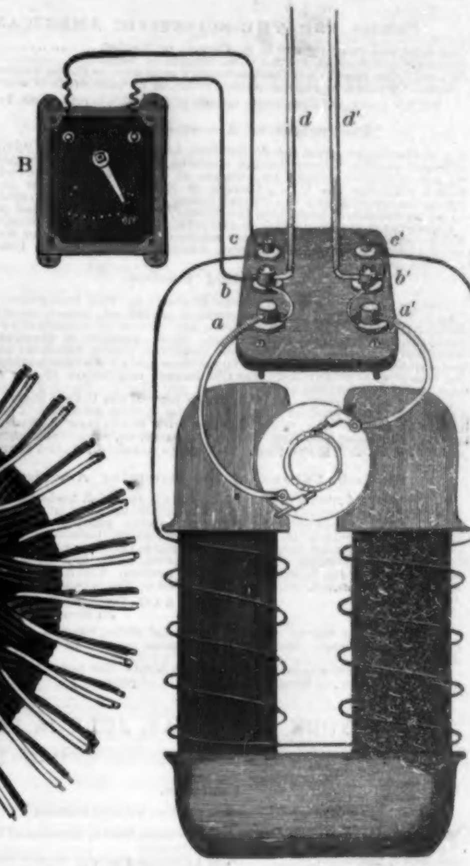
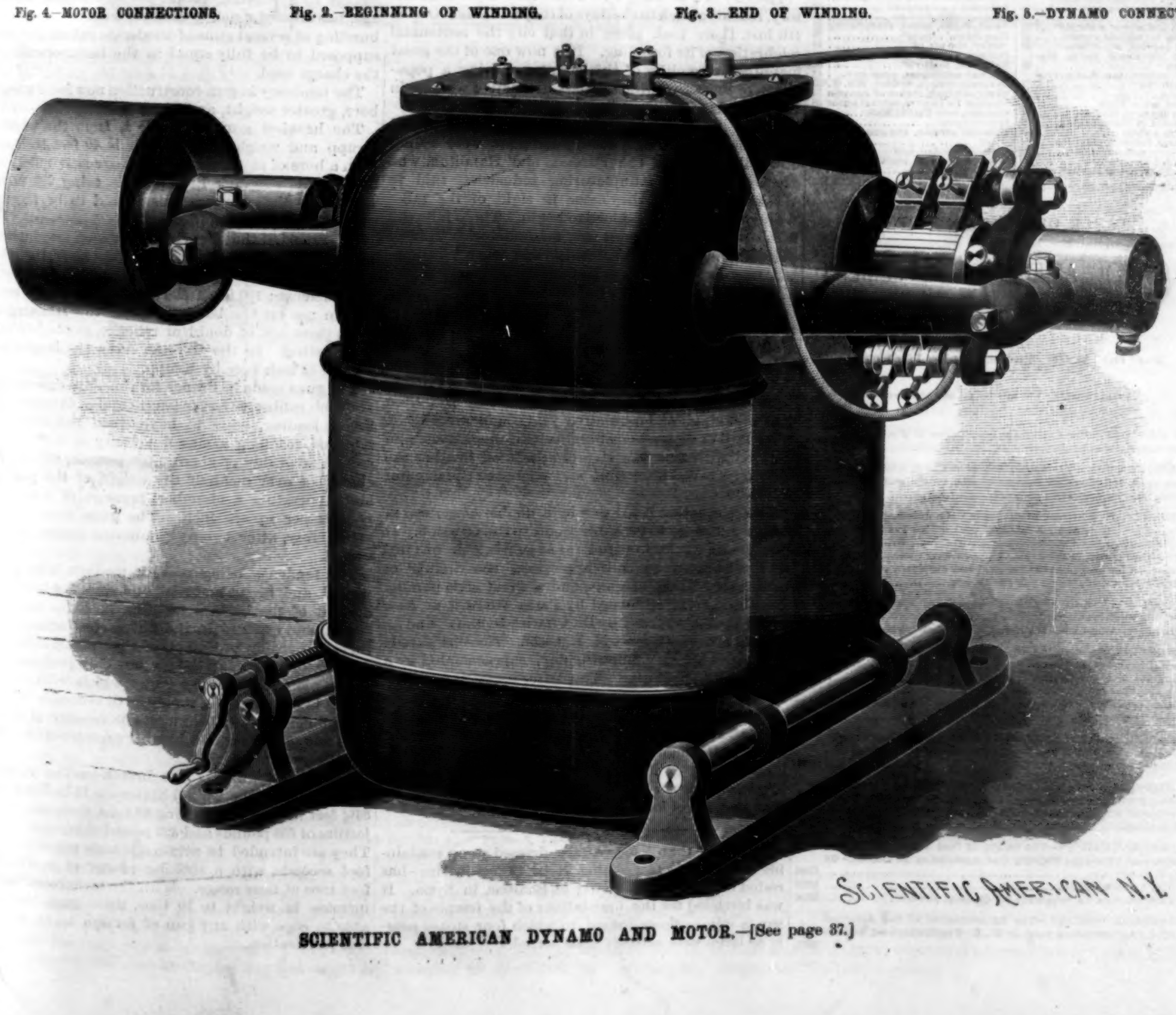


Fig. 5.—DYNAMO CONNECTIONS.



SCIENTIFIC AMERICAN DYNAMO AND MOTOR.—[See page 37.]

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NEW YORK, SATURDAY, JULY 16, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 863.

For the Week Ending July 16, 1892.

Price 10 cents. For sale by all newsdealers.

THE GENERATION OF THUNDER STORMS.

The primary cause of the constant negative charge of electricity on our earth's surface is still an open question. Did the earth obtain it at the time of its primitive evolution from chaos, and has the charge been preserved since then, partially by an atmosphere, which cannot contain, conduct, nor convey electricity, but principally by the vacuum beyond our atmosphere, such as at present we may obtain with our improved air pumps, to such a perfection that it is an absolute non-conductor of electricity, through which not a trace of the earth's electric charge can possibly pass and be lost?

Watery vapors, which frequently float in our atmosphere, are only receptacles of electric charges, and may obtain the negative charges of the earth's surface by direct contact, for instance when a mist or fog reaches the soil, in which case the earth's conducting and negatively charged surface is transferred to the upper limit of the fog; when, now, by air currents begotten by solar heat, the fog is caused to ascend and separate itself from the earth, by which it will be repelled (having the same charge), it will give origin to negatively charged clouds which then in their turn may act inductively upon other clouds. In the same way the earth acts, and causes the nearest portion of the neutral clouds to become positive and the most distant portions negative; if then such clouds while under this inductive influence become split up by air currents, they give rise to clouds charged positively and others charged negatively, and it is seen how the inductive action repeated over and over again may under proper circumstances develop and multiply the charges and give origin to the thunder storms. This happens when the clouds discharge their excess of electricity to one another or to the earth, and so tend to restore the neutral condition, which is the electric equilibrium.

This action and reaction is beautifully illustrated by an old contrivance called the electric multiplicator, in which some condensing plates, attached to a revolving axis, are caused by the revolution of the axis to act and react inductively upon one another, and in this way cause even the small spark of an electrophorus to be multiplied sufficiently to charge a Leyden jar sufficiently to administer a severe shock.

The double plate machines, which have superseded the old friction machines, are highly improved modifications of the old multiplicator.

PATERSON'S CENTENNIAL.

The city of Paterson, New Jersey, has a peculiar history, reaching back to the days of the revolution. On the 4th inst. there took place in that city the centennial celebration of its founding. It is now one of the great manufacturing cities of this country, having a population of 80,000, of which 30,000 are active workers in the mills and workshops.

During the revolutionary war, Washington and Alexander Hamilton, so the story goes, were riding down the bank of the Passaic, and Hamilton, who greatly favored manufacturing industries, said to Washington when they came in sight of the falls: "There will be a good place to begin. Those falls will furnish the power for our first manufactories." After independence became a reality, and when Washington was President, and Hamilton Secretary of the Treasury, his thoughts reverted to the beautiful Falls of the Passaic, and he immediately set about laying the foundations for the first manufacturing city in the United States.

Paterson, a plain farmer, who was Governor of New Jersey, signed the papers for a "Society for the Establishing of Useful Manufactories," which Hamilton had organized, and a hundred years ago, on July 4, the board of directors met and settled upon a site and decided upon a name. Hamilton refused to allow the city to be called after him, and suggested the name of Paterson.

The celebration being one in a double sense, was of such a nature as to give due credit to the occasion. It began with a salute of 100 guns at sunrise. It was further celebrated by church services, the ringing of bells, more firing of guns, and a great civic parade. The throng was addressed by Parke Godwin, of New York; a poem was read by Dr. Charles D. Shaw, and an oration given by George M. Robeson. Another parade was given on the following day, supplemented by a banquet and fireworks. This latter occasion was honored by the presence of Governor Abbett.

Paterson, as will be remembered, is noted for its silk mills and iron works. About thirty companies are engaged in the manufacture of silk goods, and there is a large number of iron works, including rolling mills, forges, and two or three establishments engaged in the manufacture of locomotives.

FOR more than 2,000 years, a dressed stone containing 12,922 cubic feet—being 71 by 13 feet in size—has rested on pillars in a quarry at Baalbac, in Syria. It was intended for the foundations of the temple of the sun, a mile or more distant, to which four stones nearly as large were actually transported.

GREAT GUNS AND ARMOR PLATE.

It has been said that the day of monster guns for use on shipboard is passed, and if the failures of several 110 ton guns of 16¼ inch caliber, in the British navy, are any criterion of the causes of failure being due to large ring masses shrunk on to one continuous liner, and the series of rings only holding together by shrinkage friction, there certainly is indicated a limit to the resistance of piled-up guns of such great weight and caliber to the intense explosive action expected from their size.

Splitting of the re-enforcing hoops, elongation and warping of the liners, are some of the troubles of their trials with moderate charges. Some of the guns of less caliber have split their linings and an 8 inch and a 6 inch gun have burst on target trials.

Defects have attended the fitting of the liners, so that in two instances they have turned by the enormous friction of the projectiles in following the rifling. It is now a mooted as well as a serious question as to the life of these guns, as none have been used to their full allowance of ammunition, nor can the number of shots be safely assigned as the duty of such guns, although their immense power has been tested in a single instance with a Holtzer armor-piercing projectile weighing 1,813 pounds with a charge of 960 pounds of powder, a striking velocity of 2,079 feet per second, and with the enormous striking energy of over 54,000 foot tons, at a range of 500 feet. This shot has made a world of newspaper talk, as it penetrated a target composed of a facing of 20 inches of the Brown compound iron plate backed by 8 inches of wrought iron plate, and by 20 feet of oak timber, 5 feet of granite masonry, 11 feet of concrete, and lodged in a final backing of brick, making a clean cut of 45 feet through one of the most solid targets ever built. But, alas! it was its last shot. Having been fired only sixteen rounds, not all full charges, its chase was found to droop so much and its hoops separated to an extent as to render it useless and unsafe. It was condemned.

The large-caliber guns (16¼ inch) in France have shown a marked weakness, and it is intimated through French publications that all their naval guns of over 12¼ inch caliber have proved far from being satisfactory.

The enormous pressure in the chamber of a gun and its control is one of the most difficult problems that the engineer has had to deal with, ranging as it may in pressure from 4,000 to 35,000 pounds to the square inch of surface in the bore, together with the uncertainty of high explosive material in its liability to change its detonating properties by handling or storage, has created much uneasiness from the fact of the bursting of several guns of moderate caliber that were supposed to be fully equal in the factor of safety for the charge used.

The tendency in gun construction now is for medium bore, greater weight, and better material.

The heaviest gun yet made is from the works of Krupp and weighs 135 tons; it is 40 feet in length, with a bore of 13¼ inches. Its range is 11 miles, with a projectile weighing 1,800 pounds, using 700 pounds powder to the charge. This is said to be the most powerful gun in the world.

It is reported that the 119 ton guns of 15¾ inch caliber, made by Krupp for the Italian navy, have been removed from the vessels and mounted on shore for coast defense; 100 ton and 105 ton guns are the largest now in use on the battle ships of the Italian navy. Even these are of doubtful reliance, as one has failed by bursting. In the German navy the largest guns are the 12 inch bore by Krupp.

The guns made in France for the Japanese navy, of 12·6 inch caliber, 40 feet in length and of 65 tons weight, breech-loading, seem to have stood the severe test required, reaching a muzzle velocity of 2,308 feet per second, with shot of about 1,000 pounds, with powder charge of over one-half the weight of the projectile and generating a chamber pressure of over 35,000 pounds per square inch. The guns were declared satisfactory, after twenty graduated rounds, and accepted.

The tendency being now for medium bore, greater weight, and better material, and since the later development of the highest resisting power to both penetration and fracture in the nickel-steel armor plates, there is a strong presumption that nickel-steel is the *Ultima Thule* in material for not only projectiles and armor plate, but for the guns; which, with the best efforts in construction, should give ordnance of medium caliber able to bear a muzzle velocity of at least 2,500 foot seconds and a chamber pressure of over 40,000 pounds per square inch.

The largest guns of the breech-loading rifle type now making in the United States are 12 inches in bore, 36½ feet in length, weighing 46 tons, designed for projectiles of 850 pounds and 425 pound charges of powder. They are intended to attain a muzzle velocity of 2,100 foot seconds, with a striking energy of nearly 26,000 foot tons at near range. With the nickel-steel and an increase in weight to 50 tons, these guns should be able to cope with any gun of foreign make in range and penetration.

The increase in the tenacity of steel by use of a 2½ per cent nickel alloy, combined with the later process of fluid compression, will result in the addition of a large percentage to the strength and resistance of guns and armor plate, as well also to the tenacity of armor-piercing shot, which are now disposed to break up under their high velocities and the great resistance shown by the new nickel-steel plates.

The increased facilities for forging and finishing are lessening the number of hoops by increasing their length, so as to stiffen the linings and prevent the sagging which has heretofore been a source of destruction in built-up guns.

Invention a Study.

To a certain extent only is genius an inheritance; so are oratory and statesmanship. The world has produced but few Edisons or Websters or Lincolns—born geniuses, orators, and statesmen. Education and study improve all of these qualities. Necessity often develops remarkable originality. Great inventors were generally of poor parentage, and industrious thinkers are seeking a competence through their own originality. In order to accomplish this, one should study one's own capabilities and inclinations. Some prefer chemistry, others mechanism; some to working wood, others prefer metals. I was brought up on a farm, but never liked that business, and the morning I was of age (21) my father asked me what I was going to follow for a livelihood. I said, "Well, I have not fully decided yet, only that I am not going to scratch the face of Mother Earth all my life for a living." Mechanism can be quite as profitably employed in farming as in a machine shop or wood working. I started as a house carpenter at work by the month.

At that time, in Maine, there was abundant timber and but few sawmills, and they the old style of up and down sash mills that all ran by water and did not saw more than two thousand feet in twelve hours. There being long, cold winters, large barns were built of heavy hewn timber; some of the smaller parts were generally sawed. This hewn timber must be all taken out of wind and counter-lined, and mortises and all other work measured from the counter lines. A boss framer could get $2.25 to $2.50 per day. I hired with a framer at $15 a month, and when the other hands were setting down resting I was going over the work, measuring lengths and the angles of braces, etc., and questioning the boss, and by the time we got up three barns I was conceited enough to believe I could lay out the work, as they then called it. So I quit and took the job to frame a forty-foot square barn. I only charged $1.75 per day on my first job, and only took on four or five helpers. I drew my plans as best I could and went at it, and my old boss—a very nice man, by the way—predicted a failure. This somewhat alarmed the man I was at work for as a boss framer, but I assured him that I would succeed. It was "root, hog, or die" then, so I worked and studied day and night, and all one Sunday. The day came for raising, and I sent for my old boss to be there, but the result was as good a job as I ever did, and I may say ever saw done. I saw that old barn two years ago, and it was then more than forty years old. When the barn was up, my old boss stood on the great beams and proposed three cheers for the new framer, which was heartily responded to by the raisers, as we called them. From that time I commanded my $2.25 to $2.50 per day, and had all I could do. I mention this merely to show what persistence may do.

I finally gave up wood working and took up the working of metals; and of metals I think that I have taken out over two hundred patents, some worthless, of course, but most of them very valuable. I do not, nor ever did, regard myself as more than an ordinary mechanic, and rather a rough workman at that, and yet I think that I possessed one rather remarkable quality, and that was never giving a thing up that I started. Persistence seemed to be my crowning quality. More than fifty years ago I worked in Lowell, Mass. Cotton factories were then being built all through the New England States, specially in Lowell and Manchester, N. H. Cards for use in mills had all been made by hand up to about that time. To punch the holes through the leather by hand and cut off the small steel wires, bend them in U shape, stick them through, and then bend them again on the opposite side, so as to pitch them forward, was indeed a tedious and slow process.

A card maker in Lowell, whose name I have forgotten, conceived the idea of doing all these operations by machinery, so he set himself at work. The leather must be stretched on a frame, and the frame feed lengthwise the leather, and two holes punched at regular distances apart until each end was reached, then the leather must rise up for another row of holes and feed back and forth, that is, right and left. The wire was on a reel and fed by machinery to exact length, and cut off, bent to U shape, and stuck through each hole as it was made. In time his machine was perfected, all except bending the wires on the opposite side to give them the proper pitch for carding.

The inventor said that he studied day and night for months and months to devise a means, and nearly gave it up. One night he was out walking the street and in a study, when all at once the method struck him, and he went home and made a pencil sketch, and went to bed and slept soundly, and next day went to work, made the attachment, and it was a perfect success. I have stood and seen one man in Lowell operating six or seven of these machines, setting card teeth. I think that I have seen quite as many intricate machines at work as any one person, and I still think that the card-setting machine is one of if not the most ingenious machines that I ever saw in successful operation. In this inventor ingenuity, perseverance, and patience were combined.

Often some grand idea will come to a person accidentally, as the turning of irregular forms did to Mr. Blanchard. Mr. Blanchard had acquired something of a reputation for ingenuity, and as he was one day at the United States armory in Springfield, Mass., he saw the workmen polishing gun barrels; they did all by hand then. All of the barrels are tapering, and it was necessary in the last polish that the lines be as near perfectly true as possible, so that in taking sight the eye would not be misled. To do this required practice and skill; so Mr. Blanchard took a contract to build and put a machine at work that would polish perfectly about six barrels at once. His machine was set at work one Saturday, and went right off. The scourers, as they were called, were made flexible, so as to yield to the irregular shapes as they ascended and descended, and the machine was accepted and did the work of more than a dozen experienced polishers. The workmen were, of course, interested, and as they were looking on and making remarks, one said, "Well, Bill, that throws you out of a job." When a workman that came from another room said to Blanchard, "Well, mister, you can't get up a machine that will throw me out of my job," said Blanchard, "What is your job?" "Making gun stocks," said the man. "Well," said Blanchard, "I don't know. I have not studied on it." Yet Mr. Blanchard rode home, a distance of about twenty miles, and said afterward, "On my way I studied up a method to turn irregular forms, built a machine, took out a patent for it, sold the right to government for $20,000, and actually did throw that man out of his job." Said Blanchard, "I was sorry for the man, but glad for myself." That invention made him a fortune, and he died quite wealthy.

J. E. EMERSON.

The Utilization of Niagara Falls.

Professor George Forbes, F.R.S., has communicated to the London *Times* a letter on the extensive works for the utilization of the Niagara Falls in the production of electricity, from which the following extract has been made. Prof. Forbes, after referring to his dreams of eight years ago, when he stood on the southern edge of the American Fall, writes:

"And now eight years after I see that the preparations are almost complete for the utilization of 100,000 horse power, and part of this power will certainly be used long before the close of the year.

"Few people in England who have heard of this engineering feat are aware of how far it has been advanced. More than a mile above the falls a canal has been cut, 1,500 feet long, at right angles to the river. A vertical shaft, 140 feet deep, is being sunk, and from a lower level a tunnel, 28 feet high and 18 feet wide and 6,700 feet long has been carried at a slope of 7 per 1,000, to issue at the foot of the cliffs below the falls, just under the suspension bridge. This work is all nearly completed. The lining of the tunnel with four courses of bricks is going on at the rate of 100,000 a day, and this rate is about to be increased. The turbines are in hand. Part of the power is to be used in factories now being built directly over shafts, and we are now preparing for the electrical transmission of power. In a year's time it is probable that the city of Niagara Falls will be lighted by this power, and the street electric railways worked by it. Factories are being erected on the vast extent of land owned by the company, which has a perpetual right to use this power over five miles of river frontage, from a little above the falls upward.

"Already thirty acres of land have been reclaimed by the company from the river, and the river is about to be deepened in front of their wharves. A railway, five miles long, all passing through the company's land, is in hand to connect the three lines of railway with the principal factories on the company's property. This will eventually be worked by an electric locomotive. Streets have been laid out, and a part has been laid aside for operatives' cottages. All this I have seen, and I recognize the foundation of an important manufacturing center. Franchises have been obtained from owners of property for a second tunnel under the city of Niagara Falls. All this has been done, and at a surprising small cost, by the energy, caution, and foresight of the directors of the company, of which Mr. Adams is the president, Mr. Wickes and Mr. Stetson vice-presidents, and Mr. Rankine (a cousin of Prof. Macquorne Rankine) the secretary. In 1890 they appointed a commission of leading scientific men in Europe and America, presided over by Lord Kelvin. These commissioners considered all the proposals submitted, and since then the company's engineers have dealt with the hydraulic problems. The Board of Engineers includes the names of such men as Prof. Coleman Sellers, Mr. Herschel, and Col. Turrentini, of Geneva. The electric part of the work is now to be carried out. In 1890, when preparing plans to lay before the commission, I proposed to employ alternating currents, using as motors either the alternating dynamo or the multiphase motor, which has since attracted so much attention at Frankfort last year. This was an innovation on previous practice, and it is worthy of record that the commission were unanimous (with one exception) in desiring to pass a resolution, saying that alternating currents were not available for the purpose. Already opinion has changed, and the subsequent progress has so completely borne out the views expressed in 1890 that we are going to adopt this method.

"It may be that what I have already written may convince many of the enormous character of this undertaking. But the importance of the company's transactions has been only half told. They have lately acquired from Canada the exclusive right to use land in the Victoria Park for the same purpose for 100 years. The river above the Horseshoe Fall, on the Canadian side, has a branch going round Cedar Island. The power house can be built here. Enough water can be brought through the branch to utilize 250,000 horse power, and the tunnel from the bottom of the shaft to the very base of the fall will be only about 800 feet long. This franchise is a most valuable addition to the powers possessed by the company on the other side.

"Many visitors to the Chicago Exposition next year will stop to see the progress of this gigantic undertaking, and they will not be disappointed, and it is a matter for congratulation that, so far as the present intentions of the company go, the beauty of the falls will not be affected nor the volume of water perceptibly diminished."

Dangers of Ballooning.

The Independence Day celebration at Boston closed with a tragedy in the upper air. Prof. G. A. Rogers, the well known aeronaut, who had made one hundred and eighteen balloon ascensions, together with Thomas Fenton and De Los Goldsmith, a reporter, made a balloon ascension from Boston Common as the final feature of the observance of the day. The balloon, when released, shot up perpendicularly, and after reaching the height of about a mile was blown seaward at a rapid rate; then it began to descend. It was supposed by observers that Prof. Rogers had opened the safety valve with the intention of descending before the balloon was out at sea. While the crowd watched, the balloon suddenly collapsed and fell into the bay; the car sank and the folds of the balloon settled over the occupants. Two of these were seen to emerge from beneath the balloon, one being Prof. Rogers, the other Reporter Goldsmith. Fenton did not come to the surface. Goldsmith swam easily and was rescued, but Prof. Rogers seemed to have sustained some injury, and just before assistance reached him he threw up his hands and sank. The body of Prof. Rogers has not been recovered; Fenton's body was brought into view as the rigging of the balloon was drawn up by the rescuing party. Fenton's neck had been caught in one of the meshes of the net. His body was warm when taken from the water, but all efforts to resuscitate him failed.

Ozonine.

A new product, called ozonine, appears to be destined to render services in the bleaching industries.

In the proportion of 15 grains to a quart of water, the product acts energetically upon fibers, wood, straw, cork, and paper, as well as upon solutions of gum and upon soaps; and the effect of the bleaching is identical in acid and alkaline solutions.

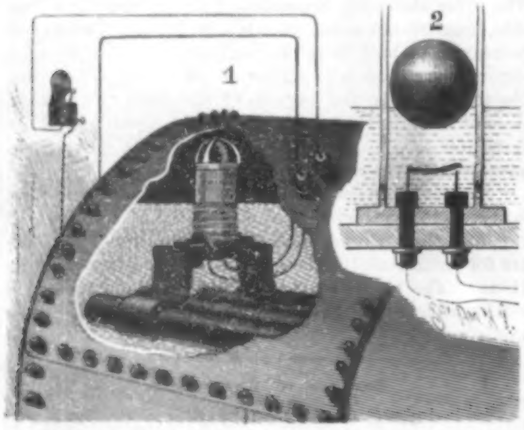
The product is obtained in the following manner: 125 parts of resin are dissolved in 200 parts of oil of turpentine, and to this is added a solution of 25 parts of hydrate of potassa in 40 parts of water and 90 parts of peroxide of hydrogen. The jelly obtained, on exposure to the light, changes in two or three days into a clear fluid, to which the name of ozonine has been given. This transformation can be obtained also in the dark, but in that case it requires several weeks for its completion.—*Le Genie Civil.*

What Patents Have Done.

Disparagement of patents is common and easy, says the *Iron Industry Gazette*, but it should not be forgotten by those who sneer at inventors that, out of a total of over $8,000,000,000 of capital invested in manufacturing in the United States, patents form the basis for the investment of about $6,000,000,000. Evidently, the United States system of encouraging invention, that has resulted in the patenting of over 476,000 inventions, is a system that is exceedingly wise and valuable. The one thing that has enabled manufactures to make so wonderful progress in the United States is the patent system.

A LOW WATER ALARM FOR BOILERS.

The illustration shows a simple, inexpensive, and extremely efficient device for giving an alarm when the water in a boiler in connection with which it is employed reaches the lowest level to which it may be allowed to fall. A casing is supported by brackets or other means in the water in the boiler, but preferably upon brackets attached to the tubes or flues, as shown in Fig. 1, and within the casing is a ball float, which rises and falls with the water. When the water reaches its lowest predetermined level, the ball rests upon a spring having a contact point at its free end, as shown in Fig. 2, and secured on an insulated plate attached to the bottom of the casing. The spring is connected with a wire forming part of an electric circuit, the other wire belonging to the circuit connecting with the contact plate engaged by the point of the spring, when the latter is pressed on by the weight of the ball. The wires are connected with a battery or other suitable source of electric supply, and in the circuit is a bell, gong, or other kind of alarm, of any approved construction, the alarm being sounded by the establishing of the electric circuit, which is accomplished when, by



MATHEWS' ELECTRIC LOW WATER ALARM.

the lowering of the water, the ball rests upon and presses down the free end of the spring.

Further information relative to this improvement may be obtained of the patentee, M. Stephen M. Mathews, box 1158, Montreal, Canada.

UNDERGROUND LOCOMOTIVE.

The engraving illustrates a small four-wheeled locomotive constructed by Messrs. Bickle & Co., engineers, Plymouth, for undergound haulage at the Levant Mines, Cornwall, to the designs of Mr. George Eustice, consulting engineer. The mines are situated on the rugged Cornish cliffs near the Land's End, and the underground levels extend for many miles under the Atlantic ocean; these levels are in places tortuous, and not exceeding five feet in height. Hitherto the metalliferous ores have been "trammed" by manual labor, from the various workings to the winding shaft. To lessen the cost of this work it was decided to employ a small locomotive, actuated by steam, and specially designed to meet these exceptional requirements. The boiler is constructed of steel with 33 in. by 2 in. gun metal tubes, for a working pressure of 100 lb. per square inch, with a large steam space to obviate as much as possible the necessity of stoking while passing through the smaller levels.

The cylinders are 4 in. diameter by 7 in. stroke, fitted underneath the boiler with the usual type of locomotive, valves and reversing gear. A powerful toggle joint foot brake is provided to control the load on the gradients, which run in places 1 in 24. At the rear of the engine a half cab is fitted with a low swing seat to give the driver command of the regulator, valve gear, foot brake, etc.

The engine has been satisfactorily tested under varying conditions on a temporary track laid at Messrs. Bickle & Co.'s yard for the purpose, and its advent in the Levant mines has been watched with considerable interest, and the engine will probably play an important part in the future development of some of the other deep and extensive Cornish mines. It is the first locomotive that has been used underground in Cornwall.—*The Engineer.*

Hook Swinging in Madras.

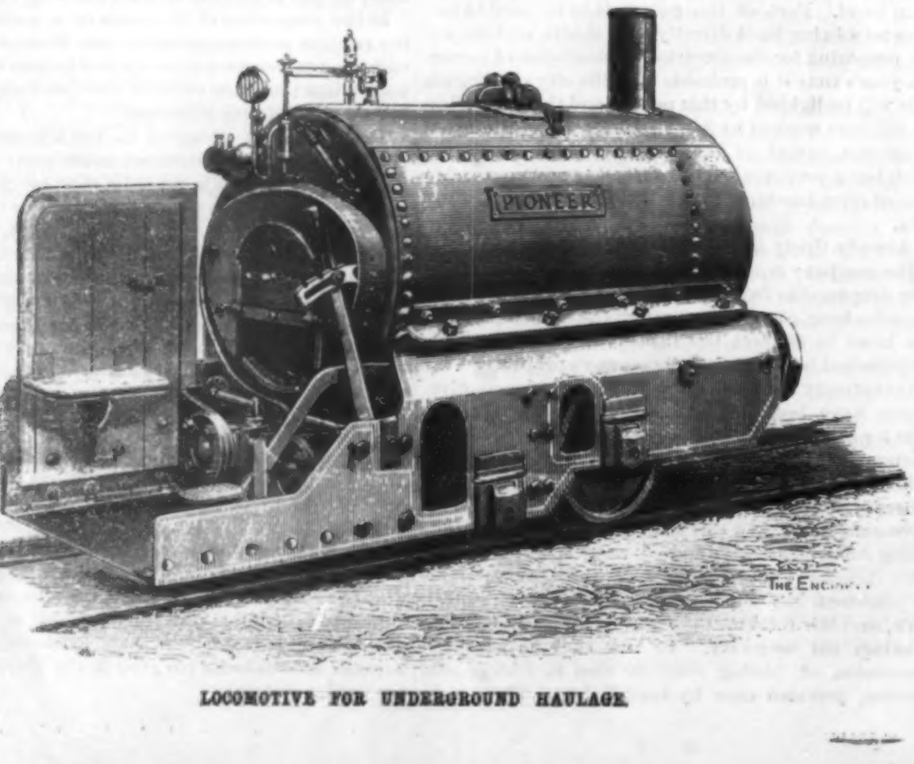
In spite (says the Madras correspondent of the London *Standard*) of the pressure of enlightened opinion and the appointment by the government of a commission of inquiry, the managers of the local festivals here do not appear disposed to abandon the practice of hook swinging. Arrangements have been made for the repetition of the rite. The person who has been induced to submit himself to the orders on this occasion is a youth of eighteen. So far, there is no sign that the authorities will interfere; the view taken in official quarters being, presumably, that as there is no immediate or necessary risk of life, and as the suffering involved is voluntarily endured by the victim, there is no ground for a criminal prosecution or prohibition. The codes, in short, protect animals from cruelty, but allow human torture, provided there is consent.

A description of this horrid practice appeared in the SCIENTIFIC AMERICAN of March 5, 1892, with illustrations showing the dreadful mode of human torture.

Chromogen I.

Under this name the Farbwerke vorm. Meister, Lucius & Bruning are placing on the market a curious product which, so far as regards its mode of using, recalls the old and well known natural dyestuff cutch. Of itself, chromogen I has no color. It is sent out, says the *Dyer and Calico Printer*, in the form of a reddish cream-colored powder, which dissolves in water or alcohol to colorless solutions. When wool or silk is immersed in an aqueous solution to which Glauber's salt and sulphuric acid have been added, they take up some of the dyestuff, and if subsequently such charged fiber is placed in an acidulated bath of bichromate of potash, a fine reddish-brown is developed. This brown is quite fast to soaping, and is but slightly affected by acids and alkalies. Chromogen I may even be used with other dyestuffs to obtain a variety of useful shades of brown. In some cases, as with alizarin yellow, the second dyestuff may be added to the chromogen bath, while others, such as patent blue, cloth red, etc., are added to the bichromate bath. It is obvious, of course, that no dyestuff can be used which is in any way acted upon by bichromate of potash. It takes rather a large proportion (7½ per cent) of chromogen I to develop a full shade; with smaller quantities some fine pale tints of brown are obtainable.

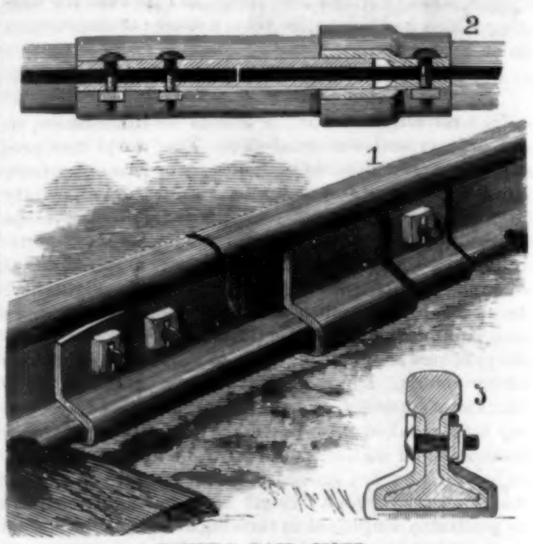
Whether chromogen I will ever come into extensive use is doubtful, owing to the fact that the results of the operation of dyeing with it are not visible until after the material has gone through the second bath; and, as a rule, a dyer likes, if possible, to be able to see how his work is progressing, and, in particular, whether he is likely to get even shades. At the same time it may be said for chromogen I, as a rule, it goes on the fiber very easily and evenly.



LOCOMOTIVE FOR UNDERGROUND HAULAGE.

AN IMPROVED RAIL JOINT.

The meeting ends of rails may, by the joint shown in the illustration, be so held together that they cannot move laterally or vertically in relation to each other, while they may have the necessary longitudinal play to allow for expansion and contraction by heat and cold. The device may also be used to unite the ends of rails without regard to whether or not the joint comes above a supporting tie. The improvement has been patented by Mr. Richard Roxby, of Dartmouth,



ROXBY'S RAIL JOINT.

Nova Scotia, Canada. As shown in perspective in Fig. 1, and in the sectional plan view, Fig. 2, a sheath is made to be easily slipped to place upon one of the rails, completely enveloping its lower portion, its vertical sides fitting snugly upon and being bolted to the web of the rail. The sheath is fastened to one rail only, but envelops the meeting ends of the two rails, another fastening sheath or jaw upon the opposite rail fitting snugly upon the outer end of the first sheaf. The securing bolts which pass through each sheath and the web of the rail have a squared portion next to the head, fitting a square hole in the sheath, to prevent their turning, and the nuts are fastened to the bolts by means of pins, as shown in Fig. 3, so that the nut cannot be accidentally removed. The main sheath is thinned and slightly rounded at the ends, and the sheaths are readily fastened to the rails and slipped one within the other, so that the joint is very easily made.

A CONVENIENT TOOL FOR PIPE FITTERS.

The accompanying illustration represents a nipple holder for the use of pipers and steam fitters to hold nipples at one end so that they can be threaded without injuring the thread at the other end of the nipple. The advantages afforded by this convenient device

AN IMPROVED NIPPLE HOLDER.

will readily be seen and appreciated by those who have had their nipple holders lost or mislaid. Any one of the arms may be grasped in a vise to bring a required size into position. The nipple is made up in the coupling as far as it can readily be screwed with the fingers, and the coupling is then run down until the nipple stops against the plug. It is then ready to be cut out, and can afterward be taken out without trouble. The tool measures 9 inches across and weighs 4¼ pounds. This handy implement has just been put on the market by the Wiley & Russell Manufacturing Company, of Greenfield, Mass.

AT the recent conversazione of the Royal Society, Dr. Gill projected on the screen a photographic star map containing the images of about 42,000 stars. As every star is a sun, we may infer therefrom something concerning the immensity of the scale on which the universe is established.

A CONVENIENT CAMERA.

BY GEO. M. HOPKINS.

While it may be too early to say the old-time plate-holder camera has had its day, it cannot be denied that magazine cameras of various kinds are superseding the old-fashioned camera, especially among tourists and others who desire to accomplish a great deal photographically in a very short time. The magazine camera is in photography what the Gatling gun is in warfare. It enables the operator to not only secure a great number of subjects, but it often allows him to get a view which would be lost if the plates were to be changed by the clumsy device of the ordinary plate holder.

The low price and good quality of plates and cut films contribute in no small degree to the success and popularity of the magazine camera. There is, however, still a bar to its very general use; that is the high price at which these instruments have been held. As their construction has been somewhat complicated, and as good workmanship is necessary to insure accuracy and reliability, the cost of manufacture has been so great as to warrant existing prices.

The engraving represents a magazine camera which is reliable in its action, and at the same time so simple that its construction is quite within the range of the amateur or ordinary mechanic.

A plate holder or kit is required for each plate or film. The holder consists of a hard wood frame a little larger—inside measurement—than the plate or the film holder, with a piece of thin veneer glued to the back. The upper edge of each holder is beveled on the front, while the lower edge is beveled on the rear, as shown in Fig. 3. Two washers or burs let into the upper part of the frame project into the space which receives the plate, and in a recess in the lower part of the frame is pivoted a button which, when turned transversely, holds the lower edge of the plate in the holder. In the face of the holder at the upper corners are formed notches for receiving the nibs of the hooks which are used for changing the plates.

The camera box is divided by a vertical partition into two compartments. In the front compartment is located the lens and shutter, while the rear compartment is subdivided into two similar chambers by a horizontal partition, which extends toward the vertical, leaving a space which is sufficient to allow the holder lying in contact with the vertical partition to be transferred from the upper chamber to the lower one.

To the rear end of the camera box—which is removable—is attached a pair of pillow springs, which hold the plate holders in the two chambers in contact with the vertical partition. To the end of each spring is attached a follower, which bears against the plate holders. The upper follower has square edges all around; the upper edge of the lower follower is beveled in the same manner as the plate holders.

The vertical partition has opposite the lens a rectangular opening, through which the plate is exposed, and in the vertical partition are formed grooves about three-sixteenths inch deep and wide. In the bottom of the box, opposite these grooves, are formed mortises, for receiving the U-shaped shifting rod, which slides in the grooves. The upper ends of these rods are reduced in thickness, and bent rearward slightly to cause the nibs at the ends of the bar to enter the notches in the upper corners of the holder. After the first plate is exposed, the shifting rod is pulled down, thus carrying the plate holder from the upper chamber downward into the lower chamber, in front of the follower, which is forced backward by the engagement of the beveled lower edge of the plate holder with the beveled upper edge of the follower. After the second exposure, the plate holder is drawn down in front of the first plate holder, and so on.

It will be seen that the magazine may be made for any number of plates.

The lens in the camera illustrated is a wide angle achromatic of short focus. It is fixed at such a distance from the plate as will enable it to cut a clear, sharp image at a distance of eight feet. No focusing mechanism is provided, as it is found that better results can be secured in a camera of this kind by having the lens in a fixed position. The lens tube is provided with a revolving diaphragm located between the lenses.

Lenses of this kind, suitable for hand cameras, can be purchased from the dealers with or without a shutter. A very simple and efficient shutter is shown in Fig. 4. It is inserted in slots formed in the lens tube, behind and very near the diaphragm. The narrow end of the plate, A, forming the fixed portion of the shutter is provided with ears, *c c*, which act as guides for the slide, B. A clip, *e*, placed on the lower end of the plate, A, guides the lower end of the slide, B. It is held in place by a lip on the lower end of the plate, A. The plate and the slide are each provided with a circular opening a little larger than the largest aperture of the diaphragm.

To the plate, A, is pivoted a spring-pressed trigger, *d*, which engages the notches in the edge of the slide, B. One end of the spring, F, is inserted in the plate, A, the other end being attached to the slide, B. The

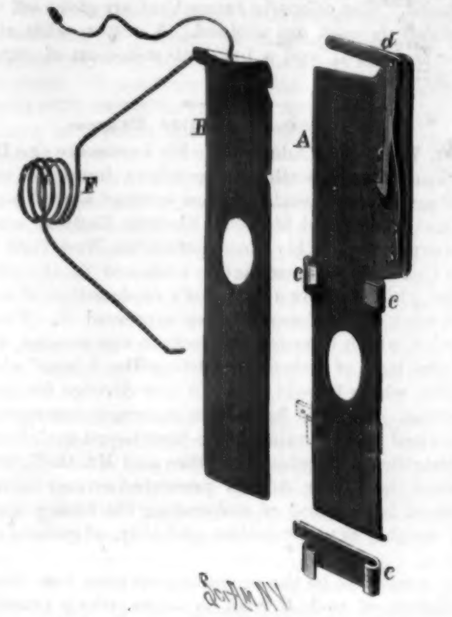
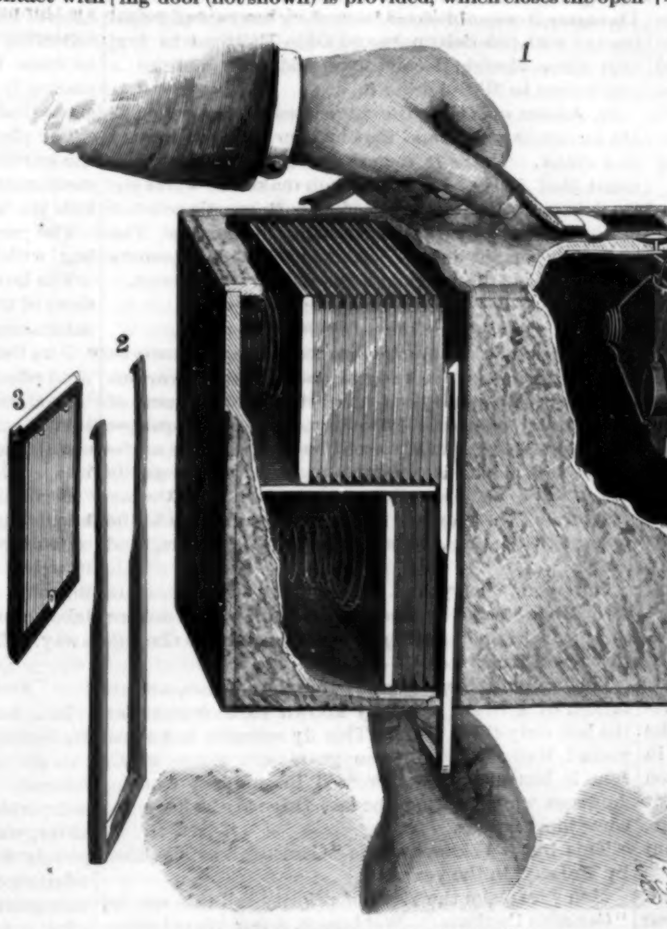


Fig. 4.—THE SHUTTER.

upper end of the slide, B, is bent over and perforated to receive a stout string, which extends through the top of the camera and is used for setting the shutter.

To the inner surface of the camera top is attached a flat spring, the free end of which projects over the horizontal arm of the trigger, *d*, and is provided with a button extending through the camera top. By pressing this button the trigger is operated and the slide, B, is released. As the slide is carried downward by the spring the holes in the slide and plate, A, coincide for an instant, thus making the exposure. To change the diaphragm it is necessary to open the front of the camera. To prevent the exposure of the plate a swinging door (not shown) is provided, which closes the opening in the vertical partition, preventing the access of light to the plate. For time exposures the shutter is set open by catching the trigger in the middle notch and using the cap. The speed of the shutter is varied by using springs of different strength.



MAGAZINE HAND CAMERA.

A CHEMIST advises that canned fruit be opened an hour or two before it is used. It is far richer after the oxygen of the air has been restored to it.

India Rubber in Chewing Gum.

A great many false statements have been made as to the composition of ordinary chewing gum. Of course where spruce gum is used, every one knows what the basis of it is, and the article is sold to-day pure and in good quality at from 50 cents to $1.50 per pound. Most of this gum is gathered in the Green Mountain regions of Vermont, and is sold through the West, as other kinds are more popular on the Atlantic seaboard. The gum, however, that is sold from candy stands and in drug stores to-day is of totally different origin and as a rule it is a manufactured product. To a certain extent this is a secret, as all India rubber compounds are secret to ordinary observers. What is known as Yucatan gum is made of gum chicle, sugar and a variety of flavors, with certain ingredients which are kept secret, but help to make a homogeneous mass. The flavors that are used are peppermint, wintergreen, licorice, pineapple, and some few medicinal ingredients.

Experts in chewing gum manufacture can tell in a minute whether good flavors are used, whether the best gum is incorporated, and just what the quality of the compound is, but in order to tell this accurately they are obliged to test it by chewing. The gum has a certain quality of sugar added to it to sweeten and make it palatable. It will be noticed that in chewing gum, after it has been in the mouth awhile, the sugar and flavor is entirely gone, and what remains is the rubber-like product, which is the chicle gum nearly pure. This gum is the sap of a Mexican tree which is called sapodilla. It grows in other countries besides Mexico, but that is the only country where a business is made of tapping it. It is collected like India rubber sap, by cutting incisions in the bark, between the months of November and April, and after the gum has been gathered, it is packed in sacks, 200 pounds to the sack. It is then a light-colored mass that appears to be about half way between gutta percha and India rubber. In the factories it is washed, dried and mixed much as India rubber is, only it needs no process of vulcanization, and when run off on the spreaders is cut into sticks, wrapped and packed ready for shipment. Within a few years the industry has assumed large proportions and the demand for it seems to be growing every day. This is the only part of the rubber business that seems to have no dull season, as one part of the year is just as good as another and chewers want their gum in winter as well as summer. It is a mistake to think that only shop girls and ignorant people chew gum, as the habit has invaded all classes of society and many physicians recommend it highly.

Tobacco chewers who are trying to give up their habit often take to chewing gum and find it of help to them. It is a curious fact that in England they do not chew gum but rather look down upon the habit as being vulgar, and of the small quantities that have been shipped abroad, but little has been sold. The time doubtless will come, however, when this democratic habit will overcome the prejudices of our cousins across the water, and when the Prince of Wales will be seen with a quid of American gum in his mouth, chewing it with as much gusto as a Bowery boy. Already Australia has thrown up her hands, and decided that gum is a necessity, and American manufacturers are working that market for all it is worth.—*India Rubber World.*

Photographing Colors.

M. Lippmann, Paris, recently admitted to the Academie some photographs of colored objects which are a decided improvement on the earlier ones. The films he employs are of albumeno-bromide of silver rendered orthochromatic by azalin and cyanin. With these he has obtained brilliant photographs of the solar spectrum after an exposure of 5 to 30 seconds. On two of these plates the colors when seen by light coming through the plate are complementary to those given by light reflected from the plate. Theory indicates that compound colors should be photographed as well as simple ones by his method, and one of his plates is a view of a stained glass window of four colors—red, green, blue, yellow; others show a group of flags, a party-colored paroquet, and a plate of oranges, with a poppy lying on the top. The shades of the objects as well as their colors are faithfully reproduced. The flags and bird were taken in five to ten minutes by means of electric or sun light, the others only after many hours of exposure to diffused light. The green of leaves and the gray tints of a stone building are also given on another plate; but the blue of the sky comes out an indigo hue. M. Lippmann is now engaged in perfecting the orthochromatism of the plate.

Gun Cotton.*

Perhaps no other formula given in the United States Pharmacopœia has proved so unsatisfactory in results in the hands of the majority of pharmacists as the one given for making gun cotton. What the result would be has always been an uncertainty with even the most careful and experienced manipulators. Sometimes the fiber would appear unaffected after long exposure to the action of the acids. Again, it would disappear entirely, having been dissolved without so much as coloring the mixture. Still again, it would, under apparently similar conditions, assume a hard, granular structure, being insoluble, and equally as disappointing as if it had disappeared altogether. Sometimes success would crown the careful effort. So uncertain, however, have been the results that by far the largest number of pharmacists have entirely abandoned the practice of preparing their gun cotton. This practice may be well enough from a commercial point of view, but is not up to the present standard of intelligent pharmacy.

Having occasion to prepare this article frequently and in considerable quantities, we began some two years ago a series of careful experiments with the view of arriving at something like certainty and uniformity in its manufacture. We made, in all, thirty-six experiments, and what we have to offer is the result of the most careful observations taken during these experiments. We have tried every formula we could find in print and followed up every suggestion and hint we could find, as given by those who have experimented before. We have used mixtures of sulphuric acid and nitric acid, sulphuric acid and nitrates, acids of different degrees of concentration and in different proportions were tried, etc., but we soon came to the conclusion that the difficulty did not all reside in the strength of the oxidizing agents nor in the relative proportions in which they were exhibited.

The process by sulphuric acid and a nitrate we abandoned as objectionable in every way. It is very offensive, tedious, inelegant and too expensive for practical use. We also soon found that our acid mixture might be of correct proportions and of proper strength, and still failure result from other causes. Not only must the acid mixture be of sufficient strength and correct proportions, but the temperature must be just right; the cotton must be free from grease and perfectly dry; it must be introduced into the acids in a proper manner; taken out at the right time, washed and dried as it should be, if success is to be assured every time. To neglect any of these points is to invite failure; to observe them all is to insure success.

Before beginning this paper we prepared eleven samples by the instructions given below; all were readily soluble in the U. S. P. mixture of alcohol and ether and each one yielded a brilliant limpid collodion of very superior quality. We found by repeated tests that five ounces prepared by this process would make as much collodion as eight ounces prepared according to the instructions given in the Pharmacopœia.

We used a mixture consisting of twelve parts of concentrated sulphuric acid, six parts of concentrated nitric acid, and one part of absorbent cotton. In working with these proportions observe closely the following directions: Pour the sulphuric acid into an open stone jar in which the nitric acid has previously been placed. When the temperature has fallen to about 35° C., place the jar in a larger vessel and surround it with broken ice. Allow the temperature to fall to 15° C. Then take the cotton, a small portion at a time, and, having carefully loosened up any compact masses, lay it carefully on the surface of the acid and with a clean glass rod press it below the surface. Keep the thermometer in the acid and watch the temperature closely. Continue the additions of cotton until all is under the acid. If at any time the temperature rises above 16·5° or 17° C. stop the additions of cotton till the thermometer registers 15° again. Allow the jar to remain in the ice without cover for about five hours. Now drain off as much of the acid as possible, using a glass rod to press it out. When, as near as possible, all the acid has been removed, protect the hands with rubber gloves and take up the cotton in small portions and wash it quickly in a large vessel of cold water. As soon as the cotton reaches the water, move it about quickly and pull it apart to prevent too great an elevation of temperature. Wash in several portions of cold water. Wring out well and spread on clean boards or paper to dry.

Do not rinse in hot water or dry by artificial heat. You will greatly injure, if not completely spoil, your product if you do. We have spoiled several fairly good samples by placing in hot water. As soon as dry, the cotton is ready for use, and if the above directions have been observed faithfully, it will be all that can be desired. If any portion is to be kept for future use, place it in an open jar and cover with distilled water. Cover the jar loosely. Do not keep it in a tightly closed container; it will make trouble.

The U. S. Pharmacopœia is very faulty in the matter of temperature. We proved to our perfect satisfaction that anything above 17° C. will always be injurious and often disastrous. The proportion of nitric acid prescribed in the Pharmacopœia is much too large for good results. If the temperature be kept down as indicated above, the same acid mixture may be used repeatedly. We have used it successfully four times.

For nearly a year we have been working by the above process, sometimes preparing five pounds at a time, and have always had perfect success. By using the acids several times over, the cost is materially reduced. The offensive fumes that are given off when a nitrate is used are avoided. A cotton with strong fiber is secured and a brilliant collodion of superior quality obtained.

* By J. G. Flint, Ph.G., Decatur, Ill., in the Western Druggist.

Dr. Adams' Electric Express.

Dr. Wellington Adams, like his namesake the Duke, appears to be a gentleman to whom immense undertakings are congenial. He has evolved a good big one in his Chicago and St. Louis Electric Railway scheme. His exposition of his ideas before the New York Electric Club left an appreciative audience in the state of mind which follows a conjuror's explanation of a difficult trick, as Professor Forbes expressed it. The discussion which followed the lecture was meager, owing to the lack of details regarding Dr. Adams' electric motor, which he said he could not divulge for patent reasons. It would have been extremely interesting to have had these details and to have heard such eminent authorities as Professor Forbes and Mr. O. T. Crosby discuss them. Dr. Adams presented several ingenious devices, his method of suspending the trolley wire being notably so and capable, probably, of general adaptation.

It seemed to be the prevailing opinion that the construction of such a road in six months is practically impossible. And yet they have a way of doing things in the West when they start out to do them.

Dr. Adams stated that 30,000,000 visitors were expected at the fair, and that he counted on 3,000,000 of them riding to St. Louis and back on his road out of curiosity. Let's see. The fair will last six months. This means that Dr. Adams will have to carry over 16,500 passengers per day. His cars hold 40 passengers each. He will need a rolling stock equipment of over 400 cars. According to the doctor's figures, the through passenger traffic between Chicago and St. Louis over all the existing steam roads amounts to but 1,200 per day. Would the doctor's railway be a sufficiently big curiosity to increase the passenger traffic from 1,200 to 16,500 per day?

This element of time is a troublesome thing. The Thomson-Houston Electric Company has recently contracted with the Baltimore and Ohio Railroad to furnish three electric locomotives, and they require a year's time to fill the order in.

Dr. Adams says that the advocates of big schemes are known as cranks and that he is proud to be known as a crank. We have remarked before in these columns that it is the cranks which make the world go. Dr. Adams is a daring projector, an enthusiastic believer in himself and an earnest advocate of his purpose. The lack of important details of this novel scheme permits the skepticism of practical men.—*Electrical Review.*

Diseases of the Malta Orange.

The insects with two membraneous wings known as Dipterans offer to the study of the naturalist various families with a prodigious number of species, many of which infest man in his dwelling, such as mosquitoes and flies, while others torment domestic animals, as the tick, which is found on sheep and cows, and the gadfly on cattle.

Several of these insects are likewise pernicious to the vegetable kingdom, consuming leaves, flowers, and fruits.

The peach, cherry, and olive, besides other trees, are specially attacked by flies, the larvæ of which devour their fruits; thus proving very detrimental to the cultivators of fruit trees.

The orange trees, especially the mandarines, are attacked by a lively, small fly known to zoologists for the last sixty-three years. This fly seems to have first visited Malta about fifteen years ago, since which time it has gradually increased in number, causing damages which, during the last three years, have become most serious.

This insect belongs to the "Ceratitis," as classified by McLeay, in the year 1829.

Men who claim the right of priority call this species "Ceratitis Capitata." Weidmann, a few years before, described the same Diptera as "Tephritis Capitata." However, the insect still continues to be known by English entomologists as "Ceratitis Citriperda," as thus designated by McLeay.

This species has for a long time been confused with the "Ceratitis Hispanica," which is found on the coast of the Mediterranean. But notwithstanding its being looked upon by some as a variety of the same, it is still an entirely different species.

With a view of studying the biology of this Diptera, the late Sir Henry Torrens named a committee, in 1889, under the presidency of the late Major-General Hales Wilkie, who, having made inquiries and studied the metamorphosis of the insects, and placed himself in communication with distinguished foreign professors, deemed it his duty to make known to the public what he and the committee learned relative to the insect in question from both a technical and practical point of view.

Biology.—The fly presents a sexual dimorphism which consists in the male having two club-shaped projections on the forehead.

It is very lively and hardy, so much so that when kept without food under a glass shade, it maintained its energy for twelve days. The female flies perforate the rind of fruits and deposit their eggs therein, from which in a few days appear the larvæ; these, destroying the pulp of the fruit, cause it to fail to the ground, where it soon decays.

The spot perforated is indicated by a dark stain, in the center of which may be observed a small hole. This admits the air necessary for the respiration of the larvæ, and through it the latter pass out when they cannot find other ways. These openings in the fruit cause it to rot.

The female insect prefers to lay its eggs on the side of the fruit most exposed to the sun, because these insects display their fullest energy under the influence of the direct rays of the sun.

The larvæ form their cocoons under ground, but one of the members of the committee, Mr. Alfonso Micallef, has observed in his garden cocoons in the chinks of walls. This shows that the larvæ go there to undergo the metamorphosis in chrysalis.

We have not been able so far to ascertain how many generations are produced during the year, but it is certainly more than one.

The wings of this insect are semi-transparent, with about sixteen brown and yellowish spots. Its claws are yellow, the head is of various colors, the breast speckled and the belly dark yellow. We have thought proper to give this brief description in order to refer the reader to that of the renowned Professor Penzig, of Genoa, at page 472 of his work entitled "Studi Bottanici sugli agrumi e sulle piante affini" (Roma, Tipografia Eredi Botta, 1887).

Means proposed by the professors consulted and by the committee.

In order to rid gardens of this destructive insect, which not only consumes acid fruits but also peaches, medlars, etc., at present scarce in the market on account of this insect, it was proposed by some to gather the infected fruit and destroy it by burning. But Major-General Hales Wilkie suggested a plan which he himself had tried in his own garden. This consists of collecting all fallen fruit before the maggots had time to come forth and bury themselves in the soil, and placing it in tanks of water, where a mash might be made that afterward might be utilized as manure.

The placing the fruit thus pounded in a pit dug in the garden and covering it with quicklime is highly recommended. The caustic property of the quicklime kills the larvæ.

The president had each fruit wrapped in a muslin bag, which was also found to be most efficacious.

The buried fruit in due course decays, and the contents of the pits form a rich accumulation of fertilizing substances of no little value to agriculture.

Two things should, however, be observed if the desired effect is to be realized.

First, the collection of the fruit should not be limited to the acid species, such as oranges and lemons, but should be extended to peaches, pears, apples, nectarines, etc., attacked by the *Ceratitis citriperda.*

Secondly, it would be necessary for all cultivators to adopt the same treatment, since should a single orchard or fruit grove infested by this insect be unattended to, it would immediately become the center of constant infection to all the neighboring gardens, and all the labor bestowed on the others would be thus thrown away.—*The Mediterranean Naturalist.*

Action of Light on Sulphite of Silver.

In a recent number of the *Chemical News*, Mr. W. H. Sodean relates some experiments with regard to this action of light which have a decided photographic interest. The salt was prepared by passing sulphurous anhydride into a solution of recrystallized nitrate of silver, washing the precipitate thoroughly, and completely desiccating by keeping it in a vacuum over a mixture of sulphuric and chromic acids. When kept in hermetically closed tubes it was slightly blackened after a fortnight's exposure to sunlight. When the temperature was raised, the blackening was more intense and more quickly brought about. It was noted also that when moisture was present, the darkening was accelerated. This latter effect might be anticipated, for it is well known that many familiar gaseous reactions are absolutely impossible when the gases before mixing and the containing vessels have been rendered perfectly free from water vapor. Quite recently, for example, it has been shown that sulphureted hydrogen gas, so fatal to silver prints and injurious to silver articles, is quite without action upon silver and other salts when quite dry.

THE SCIENTIFIC AMERICAN DYNAMO.

According to a promise given several times in the Notes and Queries columns of the SCIENTIFIC AMERICAN, we now present our readers with an illustrated description of a plain shunt-wound dynamo of simple construction, capable of supplying a current to from 60 to 75 110-volt incandescent lamps, or of being used as a 5-horse power motor.

This machine was constructed especially for the benefit of the readers of the SCIENTIFIC AMERICAN, by Mr. W. S. Bishop, of New Haven, Conn. It was designed to meet the wants of mechanics and amateurs who desire to construct a simple dynamo or motor for their own use, but who do not care to enter into the matter scientifically.

Now, although this course may enable many to make a fairly practical machine, while possibly a few may chance to build machines equal to those from the best makers, we recommend a thorough study of the principles involved in the construction and operation of dynamos and motors, before proceeding with the mechanical work. There are many good books on this subject, and there is now no excuse for ignorance in electrical matters.

The machine, as will be seen in the perspective view, is vertical, the polar extremities of the field magnet being uppermost, the journals of the armature being supported by arms thrown out from the sides of the field magnet.

The yoke is a single casting, which is planed on its upper surface to receive the squared ends of the arms of the field magnet; these arms being fastened to the yoke by tap bolts passing through the yoke into the ends of the arms.

The waists of the field magnet are slightly thicker at the middle than at the edges; this form being given to facilitate the winding. To the arms of the field magnets are fitted oblong spools of heavy paper or pasteboard, and to these spools is fitted a hardwood mandrel, which is able to resist the pressure of the wire wound upon the spools. The winding is done in a lathe, the mandrel being revolved slowly to admit of careful work.

The dimensions of the field magnet are tabulated below:

Total height of field magnet	20⅝	inches.
Width	12	"
Height of polar extremity above winding	6¼	"
Height of waist	9½	"
Thickness at the center	4½	"
Thickness of yoke	4¼	"
Diameter of bore of polar extremities	5⅛	"
Diameter of armature about	5	"
Length of arms for supporting the journal boxes of armature shaft, commutator end	9⅝	"
Pulley end	5¼	"

The principal dimensions of the armature are tabulated below:

Length of armature shaft	36⅛	inches.
Largest diameter of shaft	1⅝	"
Diameter of portion inclosed in armature core	1¼	"
Diameter of bearings	1 3/16	"
Length of armature core	11	"
Diameter of armature core	4¼	"
Diameter of pulley	6	"
Face of pulley	5	"
Length of journal boxes	4⅝	"

The details of the winding are given below:

The field magnet is wound with No. 18 Brown & Sharpe gauge single-covered magnet wire 12 layers deep, the inner ends of the two coils being connected with each other, the outer ends being connected with the commutator brushes. The armature is wound with No. 12 Brown & Sharpe gauge double-covered magnet wire, 32 coils, with 8 convolutions in each coil. There are approximately 22 feet of wire in each coil. Weight of wire on armature 17 pounds, on field magnet 52 pounds. The machine, when run at 1,450 revolutions a minute, generates a current of 35 amperes, the electromotive force being 110 volts. When the machine is used as a motor, 1½ amperes are consumed in the field magnet, and when the machine is running light only 1 ampere is consumed in the armature.

The armature core is built up of sheet iron disks 4¼ inches in diameter, with a central aperture 1¼ inches in diameter. These disks are separated by sheets of tissue paper, and clamped between end plates. They are insulated from the armature shaft by a vulcanized fiber tube ⅛ of an inch thick. The end plates which clamp the soft iron disks, and also a central thick plate located at the mid-length of the armature core, have 32 radial slits in their peripheries for receiving the wedges which separate the different armature cores. One of the end plates rests against a shoulder on the armature shaft, and is prevented from turning by a key. The other end plate is also prevented from turning on the shaft by a key, and is pressed against the disks by a nut turned on the threaded portion of the shaft. The thick disk at the center of the armature core is prevented from turning by a pin driven in a hole drilled diagonally through the armature core, the central disk and the shaft.

The armature winding is done according to the system illustrated in Figs. 2 and 3. In this case the winding of the first coil begins in space 1, is carried around through space 1*a* until the coil is complete. The armature is turned half way over, and beginning in space 2 for the second coil, the winding is carried around in the same manner, leaving the beginning and the ending of the coil in the same place and upon the same side of the armature. The armature is again reversed and the third coil is begun in space 3, leaving the intermediate space 2*a*. When coil 3 is complete, the fourth coil is begun in space 4, on the opposite side of the armature, and carried through space 2*a*. The armature is again reversed and the operation of winding is carried on in the same order, leaving a space between alternate coils upon one side of the armature. It is advisable to place mica between the different coils where they cross at opposite ends of the armature, to prevent the possibility of a cross or short circuit.

The commutator, which is of ordinary construction, has thirty-two bars and is made according to the plan already given in the SCIENTIFIC AMERICAN, also in SUPPLEMENT 600. The terminals of the coils are connected with the commutator bars in the same manner as those of the Siemens machine several times described in these columns, that is to say, the beginning of one coil and the end of the preceding coil are connected to the same bar of the commutator. This order is preserved throughout.

The journal boxes of the armature shaft are supported between arms projecting from the sides of the field magnet. They consist of an outer brass shell and an inner bronze portion fitted to the journal box by means of a ball and socket joint, the inner portion being provided with a spherical central boss, which is babbitted in the cast iron outer part held by the arms. A ring of vulcanized fiber slipped over the commutator bars is provided in its outer edge with a groove in which is tied one end of the conical sleeve of canvas forming the covering of the armature, the sleeve at this time lying outwardly. The sleeve is then reversed and the free end is stretched over the terminals of the coils, and is secured to the armature by a binding of wire surrounding the canvas and clamping it tightly to the face of the armature. Six of these bands of wire are provided for confining the winding and preventing the armature from being destroyed by centrifugal force. A slate plate on the top of the dynamo is provided with binding posts, which receive the wire supplying the current and also the wires connecting with the brushes, the safety fuses and also the shunt connections of the field magnet. The field magnet is furnished with ears at its ends, which are bored to receive rods inserted in castings designed for supporting the machine. In one of these castings is journaled one end of a screw, the other end of which enters a nut formed on the field magnet, the object being to provide means for shifting the dynamo or motor on its support to give proper tension to the belt running on its pulley.

A slate slab secured to the top of the field magnet serves as a cover for closing the gap between the polar extremities of the field magnet. To this slab are secured six binding posts, *a*, *a'*, *b*, *b'*, *c*, *c'*; the binding posts *a*, *a'*, are connected with the brushes by means of flexible cords, the binding posts, *b*, *b'*, are connected with the posts, *a*, *a'*, by fusible wires, the binding posts, *c*, *c'*, are connected with the terminals of the field magnet. When the machine is used as a motor, the connections are arranged as shown in Fig. 4. The leads, *d*, *d'*, through which the current is supplied, are connected with the wires, *e*, *e'*, through the double switch, A; they are also connected with the wires, *f*, *f'*. The wire, *e*, connects with one terminal of a rheostat, B, having a total resistance of 10 or 12 ohms. The other terminal of the rheostat is connected with the binding post, *b'*. The wire, *e'*, is connected with the binding post, *b*. The wire, *f*, is connected with the binding post *c'*, and the wire, *f'*, is connected with the binding post, *c*.

To start the motor, the switch arm of the rheostat, B, is placed on the point, which introduces its full resistance into the circuit of the armature. When the switch, A, is closed, the current remains constant in the field magnet independent of the current flowing through the armature.

Another portion of the current flows through the wires, *e*, *e'*, the rheostat, B, the fusible wires and the binding posts, *a*, *a'*, to the armature, so that in starting the motor a minimum of current passes through the armature. As soon as the armature acquires considerable velocity, the switch arm of the rheostat is moved gradually forward, the rheostat being finally cut out, so that the full current flows through the armature. The speed of the motor is then automatically regulated by counter-electromotive force.

When the machine is to be used as a dynamo, the connections are made as shown in Fig. 5, that is to say, the leads, *d*, *d'*, are connected with the binding posts, *b*, *b'*. Here the current divides. The rheostat, B, in this case is inserted in the circuit of the field magnet. The current generated in the armature passes through the binding posts, *a*, *a'*, the fusible wires, and the binding posts, *b*, *b'*, where it divides, a portion going out through the leads, *d*, *d'*, another portion passing through the field magnet, in which is inserted the rheostat, B. The current is controlled by introducing more or less resistance into the field magnet circuit by means of the rheostat.

In SUPPLEMENT 865 will be found an amplified description of the SCIENTIFIC AMERICAN dynamo and motor, together with detail scale drawings of their various parts, also a full description of the rheostat used in connection with the machine.

How to Reproduce and Improve a Faded Photograph.

Having before me several finished pellicular negatives, and supposing erroneously that the image on one of them was larger than the image on the other, I placed one negative over the other, and, looking at them by transparence, I immediately perceived that it is by the superposition of two identical images that is to be found the answer to the question: Reproduction of a faded and weak photograph. In fact, if we wish to strengthen a negative, because this negative has been obtained, as in the present example, by photographing a poor portrait on a yellow ground, the strengthening is general, and not local, portrait and background gain in intensity, but both in the same proportion, so that the advantages are null. The negative thus treated will require an exposure to the light longer than before when a positive is to be made. Contrary to what may be supposed, the superposition of the pellicles does not produce the same effect as the strengthening, this being said to reply beforehand to the objections that might be made by those who depend on theory and not on practice—two words which do not always agree. Therefore, if we wish to reproduce a weak photographic print, impression two pellicles whose sensitive surfaces have a tendency to give hardness, without seeking intensity, which, in fact, does not exist in the original; develop normally these two pellicles in a reducing bath rather rich in bromide, fix and dry in the ordinary manner. Reduce the dimensions of one of the negatives by cutting, on its four sides, a strip of a few millimeters in width. Carefully adjust the two images—which is easily done by placing the pellicular negatives on a retouching frame, or on a window pane—then fix, with small pieces of gummed paper, the two images so that they cannot be displaced from their respective positions; print in the shade under ground glass. I need not recommend that the apparatus should not have its position changed during the interval separating the two operations for printing the image, and that the focusing point should not be altered, inasmuch as this point has not varied if the camera has not been displaced. Moreover, this new method of reproduction, owing to the thickness, which has no practical importance, of the two superposed pellicles, has the advantage of giving extraordinary softness without the least blurring, and of not reproducing the grain of the paper forming the support of the image. Gain is obtained in everything—in relief, in intensity—and I may say that the copy is finer than the original, and is worth more.

Advantage may be taken of this method by applying it to other purposes. It cannot be used for portraits from life, nor for animated views, but I purpose to have recourse to it for landscapes, being convinced that the relief and softness of the image will be better rendered than by the usual process, and it seems to me that, in certain cases, by the superposition of a *time* pellicle and an *instantaneous* pellicle of the same subject, we would obtain a positive print by *addition*, which the process that I have just described is alone capable of giving, as if there were question of but a single negative and a single impression. This is to be looked into, and I advise my colleagues to make some experiments in this direction, and would be grateful if they would furnish me with the results.—*E. Forestier in L'Amateur Photographe; Photo. News.*

Cold Bathing in the Morning.

Cold bathing in the early morning is beneficial only to those persons who have sufficient vital energy and nervous force to insure good reaction with no subsequent languor or lassitude. Many persons who are greatly refreshed by their morning bath, feel tired or languid two or three hours after it. When this occurs, it is conclusive evidence against the practice. Persons who have an abundance of blood and flesh, who are lymphatic or sluggish in temperament, and whose nervous force is not depleted, can take the cold morning bath to advantage. Others who are inclined to be thin in flesh, whose hands and feet become cold and clammy on slight provocation, who digest food slowly, and assimilate it with difficulty, who are nervous and who carry large mental burdens, should avoid early morning bathing. For all such, the bath at noonday or before retiring at night is far more desirable; and it should be followed by rest of body and brain till equable conditions of circulation are re-established. Some individuals who are weak in nervous power have such excitable peripheral nerves that they get at once a perfect reaction from cool bathing, but lose in after-effects more than the value of the bath. This class of persons should not bathe too often, and should always use tepid water, choosing the time preferably before retiring.—*Jenness Miller.*

THE CENTRAL SCREW STEAMER LE LOUVRE.

While the discussions are going on concerning Paris as a seaport, some interesting experiments are still being made on the subject of the ascent of the Seine by ocean vessels. Let us recall that, among the vessels that have been seen at Paris at intervals, are the Paris-Port de Mer, a small three-master built especially for ascending the river and which was wrecked upon the coast of Brazil; the Frigorifique, which arrived from La Plata in 1878, and remained for some time opposite the Trocadero and the Court of Justice; the Volage, a schooner yacht, which, in 1889, anchored in front of the Champ de Mars; and, more recently, the Givrigne, a three-masted vessel with auxiliary engine, that arrived at Paris from Canada with a cargo of salmon preserved in its cold storage hold.

A new ship has just cast anchor at the Louvre wharf—the steamer Louvre, built by Mr. Oriolle of Nantes. When loaded it sinks but 2·8 meters in the water, and is consequently capable of ascending the Seine with a full cargo. This quality is not the only one that makes a truly original ship of the Louvre; it is the first ocean vessel provided with two central propellers. As long ago as 1869, Mr. Oriolle built the Wilhelmine, a vessel actuated by an internal propeller. Since then he has delivered over a small river yacht with internal propeller and has converted a side wheel steamer, the Abeille No. 8, into a steamer with central propeller; but all these vessels were for river service only. The results that they gave were so satisfactory that Mr. Oriolle conceived the idea of applying his new system to an ocean vessel designed for coasting trade, and so the Louvre was constructed. This vessel is 53 meters in length and 8·5 in breadth. It gauges 500 tons. It is straight-stemmed, and is provided with two masts and one funnel, all three capable of being inclined in order to pass under the numerous bridges which cross the Seine between Paris and Rouen. As seen externally, it exhibits no notable peculiarity. The two engines are triple expansion. The respective diameters of their cylinders are 34, 62, and 90 centimeters, and each of them is capable of developing 350 horse power. The boilers, which are 2·6 meters in height by 1·8 meter in length, are multitubular generators composed essentially of two inclined steel plates connected by a number of parallel tubes.

The arrangement of the propellers constituting the true originality of this vessel, we shall describe at greater length. These two propellers are placed a little forward of the center of the vessel, that is to say, forward of the boilers and engines. Each revolves in a sort of tunnel having the form of an inverted U (∩). These tunnels are 1·8 meter in height in the center, that is to say, at the place where the propeller is situated, and they are united by an inclined plane running lengthwise of the vessel. These propellers, which are 1·8 meter in diameter, and of 2 meters pitch, in revolving suck the water in front and force it aft.

As the tunnels are not closed at their lower part, the cavities that they form on each side of the center of the vessel increase the stability of it. The central propellers therefore have the advantage of putting the vessel in a state to remain at sea, which would behave very badly there (seeing the feeble draught that it possesses) were its propeller placed, as is usually the case, at the stern. The Louvre made its first trip in February. It took ten days to go from Nantes to Paris, in touching at Brest, Cherbourg and Havre. Its steadiness was perfect, at sea as well as upon the Seine, and the Parisian Steam Navigation Company, which had it constructed, has been using it since the 15th of February for the regular service between Paris and Nantes, in touching at Brest.

Including the Louvre, the maritime flotilla of Paris now comprises five ships, viz., the Emily and the Mabel, belonging to Burnett & Sons and running from Paris to London with a stop at Rouen; the Parisian and the Borey, belonging to the Parisian Steam Navi-

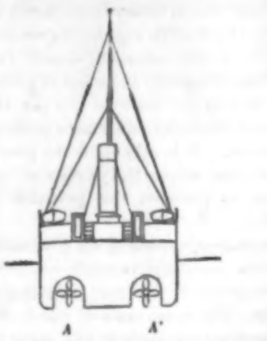
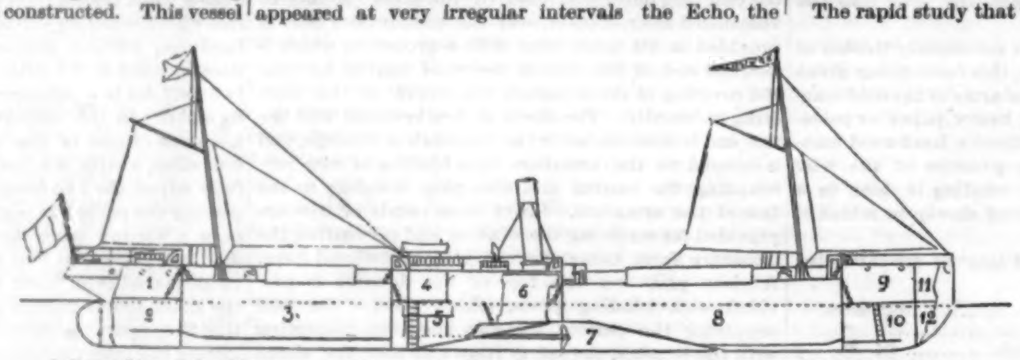


Fig. 3.—VERTICAL SECTION AMIDSHIPS.

A, A', central propellers.

gation Company, and running from Paris to Bayonne, with a stop at Havre and Rouen; and, finally, the Louvre.

It is only within a comparatively few years that ships have reached Paris. It is about thirty years ago that two steamers from London, the Jacques Paul and the Sophie, each gauging 150 tons, and which are now doing service between Nantes and Bordeaux, landed at the wharves of Paris for the first time. Then appeared at very irregular intervals the Echo, the Esther, the Arion, the Chloe and the Emily. Finally, eight years ago, a regular service was instituted, the Emily making two trips, going and coming, between Paris and London every month; and, since the Exposition of 1889, there has been adjoined to the Emily, which is a small vessel gauging but 140 tons, the Mabel, whose tonnage is 320. It takes from four to five days to make the trip between Paris and London. These two vessels do a large traffic, since in 1891 they took on board or landed at Paris more than 11,000 tons.



1. Stern cabins. 2. Provision room. 3. Aft merchandise hold. 4. Engineer's room. 5. Engine. 6. Boiler. 7. Propeller tunnel. 8. Forward merchandise hold. 9. Crew's quarters. 10. Wine hold. 11. Store room. 12. Galley.

Fig. 2.—LONGITUDINAL SECTION OF LE LOUVRE.

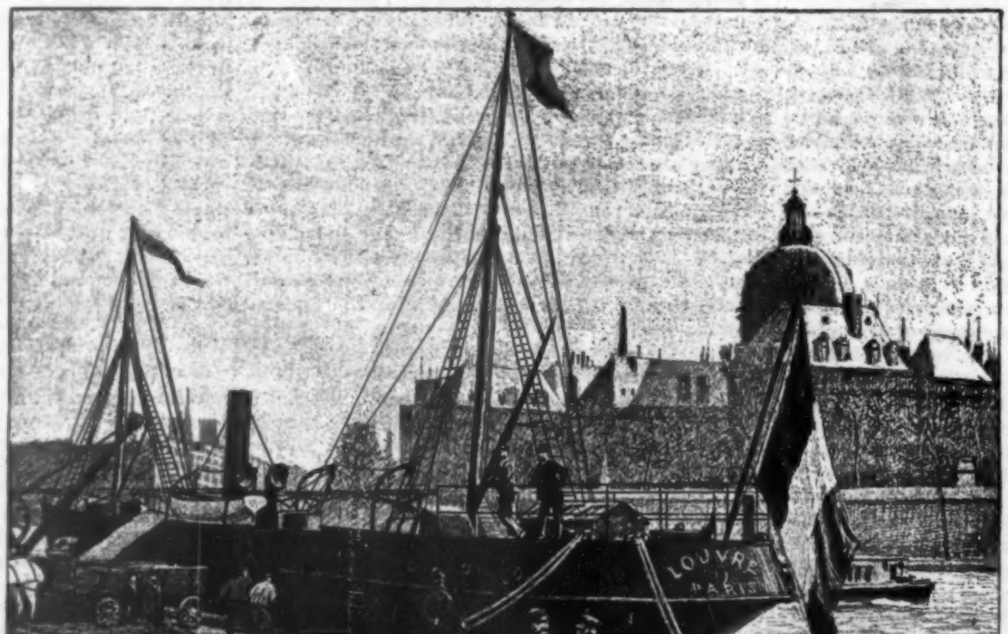


Fig. 1.—THE CENTRAL SCREW STEAMER LE LOUVRE.

They carry sugar, preserves and various commodities from Paris to London, and as they cannot descend the Seine with a full load, they complete their cargo at Rouen. At London, they take aboard for Paris leather, paper, metals, chemical products and ox horns, all commodities of which they leave a part at Rouen.

The vessels of the Parisian Steam Navigation Company are of larger tonnage than the preceding. The Parisian and the Borey gauge 650 tons, and the Louvre 500, as we have above stated. The two first run, *via* Rouen and Havre, from Paris to Bayonne, where they deliver their cargo to the Spanish ships that coast along Spain and Portugal. As the outgoing and return trips consume from 28 to 30 days, each vessel makes one voyage per month. The installation of this service is of still more recent creation than that of the service from Paris to London. It has been in operation since the month of July, 1890, only. From Paris, the Parisian and the Borey carry away for Spain refined sugar, Parisian articles, various commodities, such as oils, soaps, etc., and *materiel* for factories.

Since they cannot obtain a draught of water greater than 2·8 meters in the Seine, they are unable to carry a load of more than 450 tons between Paris and Havre; or, if there is reason for it, they complete their cargo at the last-named place. On their return, they bring to Paris wines, resins, iron from the Adour forges, etc. During the year 1891 they took aboard or discharged 26,000 tons at Paris.

Last year, the maritime flotilla of Paris carried away or brought in 37,000 tons. This figure is very low if we compare it with that of the general tonnage upon the Seine, which was 4,514,035 in 1889, and 4,734,650 in 1890.

The rapid study that we have just made of the trade done by Paris with foreign countries by means of vessels that do not ascend the Seine, and that are capable of making sea voyages, ought naturally to be completed by an enumeration of the number of loaded boats, trains or rafts which, more modest, run only from Paris to Rouen or Havre.

During the year 1891, 265 boats brought from Havre to Paris 78,144 tons of merchandise, consisting of fuel, fertilizers, wood (2,469 tons), industrial products (3,059 tons), agricultural products (63,320 tons), etc.; in 1890, Havre sent to Paris but 208 boats and 56,623 tons.

Last year, 1,160 boats or rafts brought from Rouen to Paris 428,333 tons of merchandise, sensibly the same as the amount taken to Havre; in 1890, Rouen sent to Paris only 1,326 boats and 325,318 tons. In 1891, Paris sent to Havre 80 boats or rafts, loaded with 11,665 tons (against 78 boats and 13,105 tons in 1890), and, to Rouen, 1,463 boats loaded with 77,464 tons (against 2,216 boats and 81,746 tons in 1890).

It is precisely the importance of this transit, effected by simple barges, between Rouen or Havre and Paris, that permits the adversaries of the project of making Paris a sea port to assert that there is no need of causing ships to ascend the Seine.—*Le Magasin Pittoresque.*

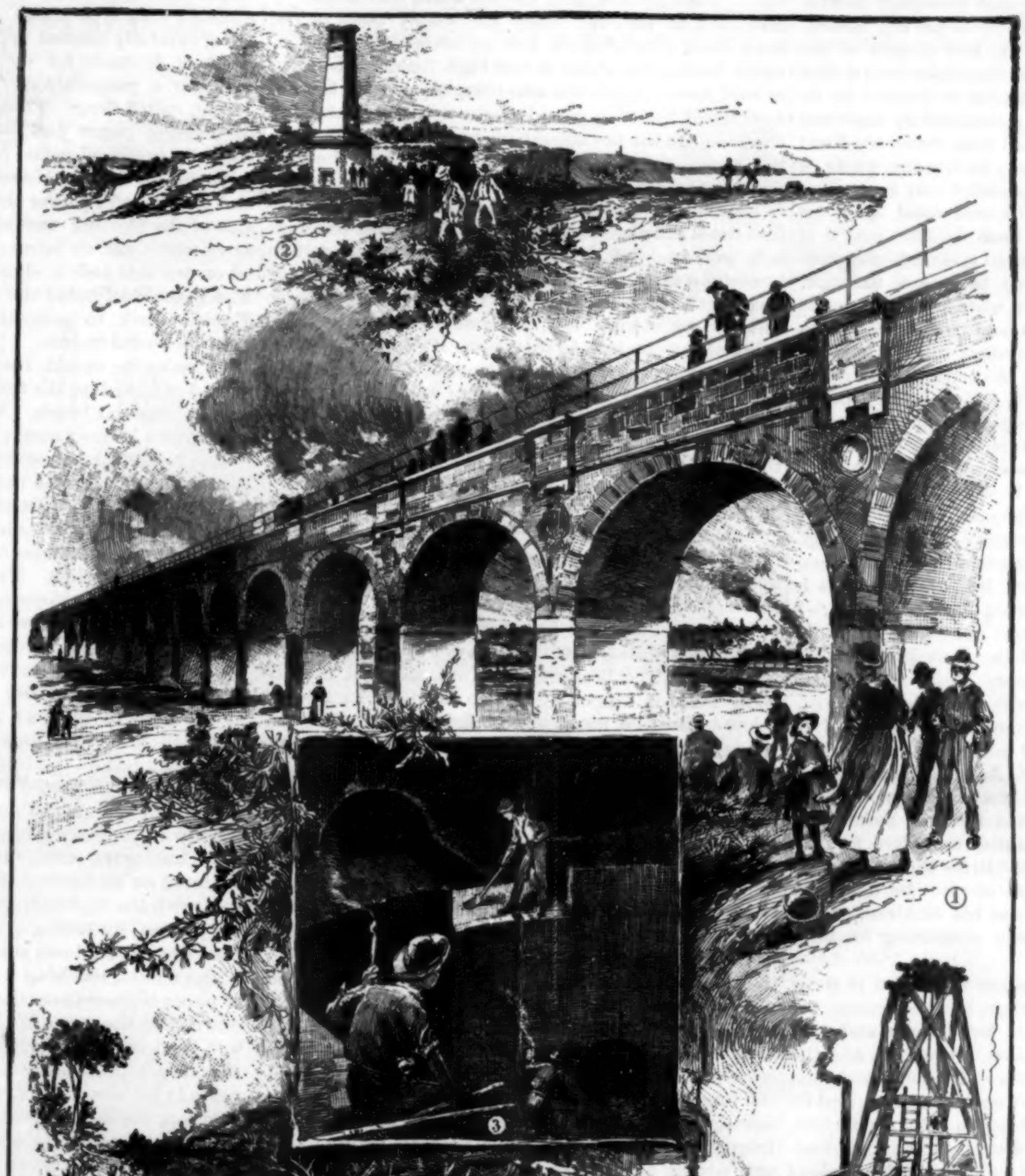
The New Chicago Tunnel.

The new 8 foot tunnel of the Chicago Water Works is now nearly completed. It extends out from the shore for a distance of four miles under Lake Michigan, and water is to be admitted at the extreme end. In this way it is expected a new supply of pure water will be obtained, in quantity about one hundred millions of gallons daily. The lake water near the shore is so contaminated with sewage as to be undesirable, if not actually dangerous. The intake of the present tunnel is 2¼ miles from the shore line, and it is alleged the sewage is more or less mixed with this water. The large death rate from typhoid indicates either bad water or some other dangerous condition of things. The statistics show 1,400 deaths from typhoid per million of inhabitants in Chicago, against 140 in London, 220 in New York, 335 in Boston.

THE SEWERAGE SYSTEMS OF SYDNEY, AUSTRALIA.

The northern main outfall sewer starts from the junction of Newtown and Parramatta Roads, just at the city boundary, and runs thence along George Street west to the Benevolent Asylum, then through Belmore Park across to the junction of College and Liverpool Streets. From here it continues along Liverpool Street for some distance, thence across Lacrozea Valley, and on through the hill to Edgecliff Road. After coming through this it crosses the low sandy area at the head of Rose Bay, once more plunges into the hillside opposite, and finally reaches the ocean, about half a mile north of Ben Buckler. The total length of the whole is 5 m. 2,700 ft. The sewer is oviform throughout, and of varying dimensions. At the upper end it is 5 ft. by 4 ft., and gradually increases in size as it progresses, till it reaches the last mile, when it becomes 8 ft. 6 in. by 7 ft. 6 in. The materials used in the work were the most carefully combined bluestone concrete for the invert, or lower part of the sewer, and brickwork of specially made bricks for the soffit, or arch above. This brickwork is packed solid to the rock throughout the tunnels with sandstone concrete. From Oxford Street to the outlet the sewer is rendered inside with Portland cement mortar to three-fourths of its height, and the brickwork carefully pointed. Along the rest of its length it is rendered all round. In the course of this work many considerable difficulties had to be met, but all were successfully overcome. The greater part of the tunneling was done in sandstone rock, but some tunnels had also to be driven through wet shale and water-charged sand. In addition, there were a couple of stretches of low-lying, sandy country to be passed over. Over these last the sewer was carried on massive concrete foundations, and, when completed, was covered by an embankment. In going through the wet rock all sorts of precautions were taken to keep the water away from the works in progress, subducts or underneath drains being the means most frequently employed. But it was the water-charged sand that gave the most trouble. It occurred on the last contract, that for the 90 chains nearest the outlet, and had to be got through partly by open cutting and partly by tunneling. Of the first the depth was never less than 30 ft., while all possible expedients had to be resorted to to keep the water down. Nine centrifugal pumps were constantly at work, pumping wells were sunk at various spots, and a subduct was laid all along the center of the sewer trench. The most interesting feature of the whole northern outfall sewer is certainly the outlet, which is absolutely unique of its kind, it being the result of the observation combined with the engineering ingenuity and skill of the departmental engineers. The sewer discharges into the ocean through the cliffs, but it is not to be supposed that it simply runs straight to the face of the cliff, and there abruptly ends. During southerly, southeasterly, or easterly gales, the waves on the coast attain enormous proportions, and strike the coastline and the cliffs with extraordinary force. No person who has not actually witnessed it can form an idea of the magnitude of the waves which roll on this coast, or of the overwhelming force with which they strike the cliffs in heavy storms. It was to be feared that if the outlet were fixed at so low a level as to be within reach of their full force, so large a body of water would be thrown into it during storms as to seriously interfere with the discharge of the sewer. The Board therefore suggested the formation within the sewer at a convenient distance of an expanding basin, where the waves would be partly broken and dispersed.

The sewer proper was brought to a conclusion 200 ft. from the cliff, and there it discharged into a chamber 36 ft. long, 24 ft. wide, and 21 ft. high. In the middle of this chamber was built a massive weir, concave on the seaward face, and having a projecting cutwater to support it, and facing up stream. In the weir wall, which extends from the cutwater to either side of the chamber, are two 4 ft. circular openings, at the level of the floor. The chamber beyond ends in two outlet tunnels (also 4 ft. circular), which penetrate to the face of the cliff in different directions, making an angle of 31° with one another. The illustration shows the interior arrangement of the chamber, access to which is obtained by means of a shaft 12 ft. by 5 ft., and 145 ft. high. The top of this shaft is protected by a brick inclosure (represented in illustration No. 2), which is some 56 ft. high, and forms quite a landmark on the cliff. The working of the chamber is shortly thus: The sewage enters in on an ogere (or S shaped) fall of 3½ ft., and meeting the cutwater, is divided by it into two streams, which run round its sides, pass through the openings in the weir wall, and then find their way to the sea by the tunnels. Whenever the sea is high, the waves rush up one or other of these tunnels, and simply expend all their force on the concave portion of the weir, which sends them hurrying back again along with the stream of sewage, which they thus do not interrupt at all. Even should two waves rush up, one through each outlet, at the same time, no harm would be done, as the water would then merely be thrown up into the inner part of the chamber, whence it would run back at once. Of course, it is necessary that this part of the work should be constructed as strongly as possible, seeing what it has to withstand, and great care has been taken that it should be. Bluestone masonry and bluestone concrete alone have been used for all within the chamber. The shaft, which merely leads to it, is lined with brick packed solid to the rock with concrete. Every possible contingency has also been provided against. The highly improbable risk of the four-foot openings in the weir wall becoming choked with rubbish has even been guarded against by leaving ample space for the sewage to flow over the wall before it could do any harm to the main sewer, while from an overhead platform within the chamber any obstruction can be removed by grappling. There are also grooves into which stop boards may be lowered at any time, and the flow of sewage shut off from any channel. This novel and interesting chamber, together with its accessories, has always worked splendidly and seems an unqualified success—as it ought to be.



1. View of aqueduct across Johnstone Creek. 2. Outlet of the Bondi main sewer at Ben Buckler, with ventilating shaft. 3. Interior of outlet chamber. 4. Waverley and Woollahra branch sewer over Double Bay Flat. 5. View of sewer shafts in Dennison Street, Waverley.

SKETCHES OF THE SEWERAGE SYSTEMS OF SYDNEY, N. S. W.

The probability that this main sewer would at some future time be extended through the Glebe and Balmain was foreseen when the northern scheme was proposed, and allowance was made for such an extension. Consequently when, in 1888, a scheme was drawn up for the drainage of the western suburbs, the provision thus made was utilized, and it was determined to continue the northern main through the Glebe, part of Leichhardt, and into Balmain. The total area that will be drained by this extension is some 1,640 acres, and it will be about 4 miles 520 yards long. The route decided upon is from the junction of the Newtown and Parramatta Roads through the Glebe, across Johnstone's Creek to Piper Street, Leichhardt, along which it continues to White's Creek. After crossing this it goes on through the Brenan Estate, entering Balmain at Foucart Street. Thence it proceeds to and along Darling Street, near the end of which it finally stops. The work is in tunnel practically all the way, except where the creeks have to be crossed. At Johnstone's Creek the flat on either side is to be traversed by the sewer on brick and concrete arches of 27 ft. 8 in. span, which, in turn, are supported on sandstone masonry and concrete piers. Immediately over the creek will be a lattice girder bridge, 42 ft. long, over which wrought iron piping, of similar diameter, will replace the brick and concrete of the former part of the sewer. The illustration reproduces the design approved for the construction of this aqueduct. The work at White's Creek also will be similar to this. In size the sewer is 5 ft. by 4 ft., and oviform in shape at its junction with the outfall, but it gradually diminishes till, at the intersection of Darling and Ann Streets, Balmain, near its head, it is only 4 ft. 2 in. by 2 ft. 6 in. North of this point it consists of 15 in. and 12 in. pipes. Of the whole area from which this main sewer is to receive the drainage, about one-third is too low to be gravitated to it; consequently, some method will have to be adopted to raise its sewage. The cost of this work has been estimated at £75,518. Operations have already been begun on this extension, November, 1890; and so vigorously have they been pushed on, that already the main sewer has been finished as far as Johnstone's Creek.

Connected with this extension of the main sewer there are to be altogether twelve sub-mains or branches, in all a length of 5 m. 513 yds., the cost of which has been estimated at £70,376. Another one also of some importance is being constructed now, but nearer the outlet end. It is called the Waverley and Woollahra branch intercepting sewer, and is nearly a

mile long. It joins the outfall at Double Bay Valley, over which it is carried on piers with concrete arches, and covered by an embankment. The illustration shows the appearance of this part of the sewer before the embankment was made over it. On the opposite side it enters the hill, and goes through it at a very great depth, some of the shafts sunk being over 200 ft. deep, and at them work is being vigorously carried on. Of course, no hand winding gear would be suitable for shafts like these. So above them tower huge tripods, known as poppet heads, and all the hauling is done by a steam engine housed close by. Besides this, authority has been given for the construction of other branches, and more will follow when funds are available. Needless to say, provision has been made all along the line for the entrance of as many as can ever be required. The main outfall also intercepts a good many old sewers directly, and still more are being turned into it by the Water and Sewerage Board, whose shafts may be seen all about in the city streets.

Such in its main features is the first system of the Sydney sewerage scheme, and it cannot be denied that it is very good. Nor can any doubts be thrown on its practical utility. All such are triumphantly answered by the fact that the main outfall from Newtown Road has been in use nearly four years, during the whole of which time it has worked splendidly and been most successful. As regards cost, the sum total spent on the northern outfall sewer has been £419,528, and it is estimated that before the northern system is complete £1,480,000 ($7,403,000) will have been got through. Though these sums sound large, what are they against the saving of life, the saving of health, and the saving of wealth which has been brought about by these works? The very shrinkage in the metropolitan death rate is well worth the money, and it is undisputed that for it the Northern Sewerage System is in a great measure responsible.—*The Illustrated Sydney News.*

How Pottery is Made.

Among the large establishments visited by the members of the American Institute of Mining Engineers at their recent Baltimore session was the Chesapeake potteries, near Baltimore, Md., and the visit is thus described by a correspondent in *Engineering:*

In 1852, before such goods were made in this country, it cost with the tariff at 24 per cent $95 to import an assorted package of ordinary white ware. Now since the manufacture of these goods here and the competition thus brought about, with a tariff of 55 per cent, the same quantity of goods of superior quality costs the consumer $46. Notwithstanding this great reduction in the cost of the goods, the employe in the United States pottery has received more than double the wages paid the English operative for the same work, and more than three times the wages paid to the German workman for like service—he has been able to live comfortably, educate his children, and if reasonably provident, lay aside something for buying a home.

It has been the aim also of those interested in these matters to start a school of design and decoration. A series of prizes were established for designs, and were open to all students in recognized art schools, and the points of award were in excellence of form, adaptation to household use, merit of relief ornamentation, and its suitability to the form. Excellence in color decoration, and its adaptation to form and strength, and originality of the designs forming the set. A plan for a school of pottery was considered in January, 1891, and Mr. D. F. Haynes, one of the proprietors of this pottery, was the chairman of the committee, and judging from his energy and character, your correspondent is of the opinion he will carry this matter to a successful issue. The Pennsylvania Museum of Philadelphia has already taken the initiative, and their liberal offer has been accepted by the committee. This pottery was a great surprise to all of the party, and the work is of a high character in design.

These potteries are located near the clay fields of Maryland, and are also on the deep-water navigation of Chesapeake Bay. The ware is divided into four grades. The first, called C C, is hard and cheap. The second, called white granite, is a finer quality. The third is called semi-porcelain, and resembles French china in color. The fourth is the china or porcelain, and is produced with great care, and requires the most thorough supervision to bring it to a state of perfection, especially in the firing.

The materials for the four grades are prepared similarly, although of course in each instance by varying the mixtures. The substance is put into a tank with revolving arms, and thoroughly mixed with water, then it is forced into a press lined with canvas bags, and the water strained off, leaving a plastic mass called "clay," although composed mostly of flint and feldspar. It now goes on a "jig," which is a rapidly revolving disk of metal, and takes the form of a saucer, plate, or some other flat object, the workman making the most marvelous changes in form by pressing a tool against the rapidly revolving mass. Such pieces as require moulding are made in two parts in the mould, and are then joined together, the seams being covered with a roll of clay which is worked off smoothly, and the mould set aside until, by the absorption of water from the piece by the plaster of the mould, and the drying of the clay from the inside, the piece has so hardened and contracted as to be easily and safely removed; then the handle, which has been made in another mould, is fitted to the body and joined fast by a slip made from clay. The whole is smoothed off, finished, and, bearing the exact impress of the mould in which it was formed, it is placed in the "green room" to dry. Careful handwork is required in all this manipulation, for, plastic as is the clay, it has rights that must be respected, and it cannot be forced too far. With all the care used, many pieces are "marred in the hands of the potter."

The dexterity displayed by the workmen is something astonishing, and it was often a question with the visitor as to what was to be the final shape of the clay. The clay now goes to the kilns, which may be described as follows: They are solidly built of red brick lined with firebrick, and are about 16 feet in diameter inside, and about 16 feet high inside to a crown or roof, above which the kiln rises, tapering in form to a sufficient height to give draught to the fires. Around the base are the fire chambers, eight or ten in number, above which are openings directly into the kiln, and from which lead flues under the floor of the kiln to the center. The kiln in which the ware receives its first fire is called the biscuit kiln. To protect the ware now prepared for firing, which is ready to fall in pieces at a careless touch, boxes made of fireclay called "saggars" are used; these are made of all shapes to suit the ware, high, low, oval, and round, the sides being about one inch in thickness. One of these filled with ware is placed on the bottom of the kiln, with a row of soft clay around the top; another saggar of the same form, likewise filled, is placed on it, and the operation repeated until the tier or "bung" reaches the top of the kiln, other "bungs" are placed close to it, and this is kept up until the kiln is filled, then the door is bricked up and plastered over, the fires are lighted and the work of burning begins.

The heat is increased from a gentle one to about 3,000° F., and this is kept up until all the materials are thoroughly fused and solidified, probably occupying two days and nights. The fire is drawn and cold air carefully excluded. In three days the cooling process is finished. The broken pieces are collected and the good work is dipped in a tub filled with glaze and taken to the kiln for a second firing. This kiln and the saggars used are similar to those used for the biscuit firing, but still greater care is required in placing the ware, for if two pieces touch when the glaze melts in firing, they will be cemented fast to each other. Hollow pieces can be placed upon the bottom of the saggars, which have been sprinkled with small bits of flint, the size of shot, to keep the ware from fastening to the saggar; but plates and flat pieces must be supported underneath by pins, with triangular points made of clay, which are inserted in holes pierced in the sides of the saggar, and they are thus carried one above another while being fired. The firing of these kilns is accomplished in about twenty-four hours, and after cooling the kiln is opened and the wares are ready for the decorating department or to be placed in the bins of the glost wareroom. With all the care the average pottery employe seems to be capable of, the frequent breakage of valuable pieces is trying to delicate nerves, and the disasters of a day will often furnish "potsherds" sufficient for a thousand afflicted Jobs. The final process now comes, viz., the decoration. The design is engraved on a copper plate, mineral colors that will stand firing are mixed with a specially prepared oil, and a print is taken from the plate on a sheet of tissue paper; this is laid in proper position upon the piece of ware to be decorated and rubbed with a flannel until it adheres firmly. After a few hours the paper is removed and the perfect print remains on the ware. This is afterward touched up with color by the women employed, their skill and knowledge having much to do with the character of the decoration produced, but no skill can compensate for the lack of a good design, or make a poor drawing anything but commonplace. Tints covering the ware, or a good part of it, are sometimes used. They are applied by first covering the piece with a thin coat of oil, upon which the color in a fine powder is dusted; when the tint has been fired, a print can be applied on it and excellent effects secured. The application of gold either in the form that fires bright without burnishing, or the preparation that requires after firing to be scoured or burnished, is made with a thin brush in same manner as color is applied.

Simple as the processes used in decoration seem to be, the field for the exercise of a refined taste in their application is boundless. The creation of good designs, the adaptation of decoration to form, the thousand combinations of color, all these deeply interest and draw forth the most earnest efforts of those who make a serious study of pottery decoration. The enamel kiln, in which the decoration is fired on the ware, is constructed with flues surrounding it, so that the fire cannot come in direct contact with the ware, and, therefore, only fireclay bats or shelves are required to place the ware upon in place of the sealed saggars used in the biscuit and glost kilns. From six to ten hours firing is needed to give the decorations permanency, when the ware is removed from the kiln, examined and wrapped for shipment.

Baltimore has five potteries and 750 employes in them. The coming exhibition at Chicago will show what wonderful advance has been made in this industry. Mr. Haynes, with great forethought, had provided souvenir plates specially decorated for the occasion, and having pictures illustrating extracts from Shakespeare.

Stereotyping.

The operation of stereotyping consists of making a mould or matrix in paper or other substance from a type form and casting therefrom a plate which may be printed from in place of the type. The type is surrounded with type-high clumps and locked up. After being carefully cleaned and brushed over with an oiled brush, it is ready for moulding. The mould is made by using a preparation of sheets of paper pasted together, called flong. Flong is made by taking a sheet of blotting paper and pasting one side of it with a specially prepared paste, hereafter described, and placing over it a sheet of tissue paper, then pasting again and putting on another sheet of tissue; next, the other side of the blotting receives two pasted tissues in the same way. Before being used a sheet of tissue is pasted on one side and a sheet of blotting on the other. The tissue side, being the face side, is dusted over with French chalk, to prevent the mould sticking and to help the metal to run.

To make the mould, the flong is placed face (or tissue side) downward on the form and beaten into the type with a large flat brush. When sufficiently beaten, the whites and hollows need packing. Strips of cardboard —about eight or ten sheet board is the proper thickness—are cut to fit the various places, and the whole is covered up with a pasted sheet of stout brown paper. The form, with the mould upon it, is then placed in the drying box, a piece of press blanket put over it, and pressure applied. The drying box is something after the form of a copying press, with an atmospheric gas burner under to give heat. After stopping in the drying box about fifteen minutes the pressure is released, the blanket removed, and the mould allowed to stay a few minutes to dry, strips of metal being placed on the edge to prevent its curling up. The mould is next taken off the form, all superfluous paper cut away, and put on the table of the drying box to further dry. A "lip" is pasted at one end consisting of brown paper, and should be sufficiently long to hang out of the top of the casting box when placed ready for casting. Casting the plate is the next operation. The mould is placed on its back on the bottom plate of the casting box, with the lip hanging out at the end of the plate; the gauges, consisting of strips of iron a pica in thickness, are placed down each side and along the bottom of the mould, reaching to the top of the plate. A piece of paper is placed over the whole, the top plate brought down, and the screw applied. The box is next placed in a perpendicular position and the metal is poured between the protruding gauges and papers. In a few seconds the metal is set, the box placed in a horizontal position, the lid removed, and the plate will be found. The mould being removed, the tang, or pour, *i. e.*, the superfluous metal, is cut away, when the plate can be trimmed and mounted on wood and is ready for use.

The paste for flong may be made by taking say 1 pound of bookbinder's paste, 1 ounce whitening beaten to a powder, 1 ounce glue (melted in double its weight of water), 1 ounce starch, and ¼ ounce powdered alum. Mix well together, reduce to consistency of thick cream, and strain through a sieve, when it will be ready for use.

To test the metal for the proper heat for casting, dip into the molten metal a piece of white paper; if the paper is scorched black, it is too hot; if it is turned cream color, it is just right. Stereo metal is not so hard as type metal, and consists of say 85 per cent of lead and 15 per cent of regulus of antimony.—*British Printer.*

The Art of Poetry by a Poet.

Poetry is commonly thought to be the language of emotion. On the contrary, most of what is so called proves the absence of all passionate excitement. It is a cold-blooded, haggard, anxious, worrying hunt after rhymes which can be made serviceable, after images which will be effective, after phrases which are sonorous; all this under limitations which restrict the natural movements of fancy and imagination.

I have sometimes thought I might consider it worth while to set up a school for instruction in the art. "Poetry taught in twelve lessons." Congenital idiocy is no disqualification. Anybody can write "poetry." It is a most unenviable distinction to have published a thin volume of verse, which nobody wanted, nobody buys, nobody reads, nobody cares for except the author, who cries over its pathos, poor fellow, and revels in its beauties, which he has all to himself.—*Dr. O. W. Holmes.*

THE AMERICAN BLACK WOLF.

The death of the last wolf seems to mark an epoch in the history of a country, of its cultivation and the complete peopling of its territories.

These animals, the rearguard of the tribes once in possession of the land, are the latest of the larger beasts of prey to be crushed out of existence by the onward march of a civilized population. Lurking in caves, amid rocks, and the most secluded parts of the remains of once extensive forests, they grow more wary as their numbers diminish, but long after the bear and the wolverine are extirpated, their gaunt forms may be occasionally seen stealing like shadows through retired parts of woodlands or broken country, seeming rather to be seeking new hiding places to elude pursuit than in search of the prey they once pursued so boldly. Wolves existed in England probably as late as the fifteenth century. In Scotland the last wolf was killed in 1680, and in Ireland in 1710. There is now at Central Park the animal of which a portrait is here given, a young black wolf, in all probability the last of a once numerous variety common in our Southern States. He is an elegantly formed animal of a glossy jet black color and noticeably of more slender proportions than the prairie wolf with which he shares his cage. Although by no means a mature animal he is already large and promises to be a magnificent specimen of his variety. He has a long slender pointed intelligent face, erect ears, and a mild, gentle expression, which in his case at least does not belie his disposition. He was presented to the Central Park zoological collection last September, by Messrs. Auston and Stone, of Boston, who obtained him when a whelp from a back-country hunter in Louisiana. It would be interesting to see the results of a cross between this beautiful animal and some of our larger shorthaired varieties of dogs. The breed is so near extinction that this is probably the only possibility of the kind that will ever exist. Audubon tells some very readable stories of the superior bravery and strength of the southern black wolf as compared with the gray variety. Writing some fifty years ago, he says:

"There is a great feeling of hostility entertained by the settlers of the wild portion of the country toward this (black) wolf, as his strength, agility, and cunning, in which last quality he is scarcely, if any, inferior to his relative, the fox, tend to render him the most destructive enemy of thin pigs, sheep, or young calves which range the forest; therefore in our country he meets with as little mercy as in any part of the world. Traps and snares of every sort are set for catching him in those districts in which he still abounds. Being more fleet and better winded than the fox, this wolf is seldom pursued with hounds or any other dogs in open chase, unless wounded."

Skull of Canis latrans

Skull of Canis lupus

THE LAST OF HIS RACE. American black wolf at Central park.

Head of black wolf

Canis Latrans

THE AMERICAN BLACK WOLF, CENTRAL PARK, NEW YORK.

On one occasion, Audubon, traveling between Henderson and Vincennes, chanced to stop at the house of a farmer, for in those days hotels were scarce in the good State of Indiana. "After putting up our horses," he says, "and refreshing ourselves we entered into conversation with our worthy host, and were invited by him to visit the wolf pits which were constructed by him about half a mile from the house. Glad of the opportunity, we accompanied him across the fields to the skirts of a neighboring forest where he had three pits within a few hundred yards of each other. They were about eight feet deep, broadest at the bottom, so as to render it impossible for the most active animal to escape from them. The mouth of each pit was covered with a revolving platform of interlaced boughs and twigs attached to a cross piece of timber which served as an axle. On this light sort of a platform, which was balanced by a heavy stick of wood fastened to the underside, a large piece of putrid venison was tied for bait. After examining all the pits we returned to the house, our host remarking he was in the habit of visiting his pits daily to see that all was right; that the wolves had been very bad that season; had destroyed nearly all his sheep and had killed one of his colts. 'But,' he added, 'I am now paying them off in full, and if I have any luck, you will see some fun in the morning.' With this expectation we retired to rest, and were all up at daylight. 'I think,' said our host, 'that all is right, for I see the dogs are anxious to get away to the pits; although they are mongrel curs, their noses are pretty keen for wolves.' As he took up his ax and gun, the dogs began to whine and bark and frisked about us, wild with delight. When we arrived at the first pit we found the platform somewhat injured and the bait had been disturbed, but the pit was empty. On examining the second pit we discovered three fine fellows safe enough in it, two brindled and one black, all of good size. They were lying flat to the earth, their ears close down to their heads, their eyes indicating fear more than anger. To our astonishment the farmer proposed going down into the pit to hamstring them, in order to haul them up, and then allow them to be killed by the dogs, which, he said, would sharpen them (the dogs) up for their next encounter with wolves, should any come near his house in future. Being novices in this kind of business we begged to be lookers-on. 'With all my heart,' said the farmer; 'stand here and see how 'tis done;' whereupon he glided down a knobbed pole, taking his ax and knife with him. We were not a little surprised at the cowardness of the wolves. The farmer stretched out their legs in succession, and with a stroke of the knife cut the principal tendon above the joint, exhibiting as little fear as though he had been marking lambs. As soon as he had thus disabled the wolves, he got out. Securing the platform, under his direction, in a perpendicular position on its axis, I held it while he made a slip knot in one end of a rope we had brought, and threw it over the head of one of the wolves. We now hauled the terrified animal to the surface; and motionless with fright, half choked, and disabled in its hind legs, the farmer slipped the rope from its neck and left it to the mercy of the dogs, who at once set upon it with great fury and worried it to death. The second was dealt with in the same manner, but the third showed more spirit. The moment the dogs set upon it, it scuffled along on its fore legs at a surprising rate, snapping furiously all the while at the dogs, several of which it bit severely. So well, indeed, did the brave animal defend itself that the farmer, apprehensive of its killing some of his pack, ran up and knocked it in the head with his ax. This wolf was a female and was one of the black variety." Many years ago, my grandfather, Col. Thomas Carter, traveling from New Orleans up toward the mouth of the Ohio, was followed a long distance by an unusually large black wolf by whom he expected every moment to be attacked. His horse had fallen lame and had to be left at the last station while he himself pursued his journey on foot. This was before the advent of steamboats. The wolf kept about twenty paces behind him, never further away or nearer; if he slackened his pace the wolf walked more slowly, if he ran the wolf trotted. As evening came on, the sunset glow made its eyes shine like fire. As the colonel was not armed he feared for his life and was relieved and delighted to discover a rough log cabin in a clearing. Climbing the rail fence that inclosed it and entering at the open door he found it deserted, and used as a storehouse for flaxseed, of which it was partly full. Wrenching from what used to be a shelf a rough piece of slab containing several projecting rusty nails he stood at bay, but the wolf's instinct forbade it to come further than the rail fence, where it remained, entertaining the occupant of the cabin with an all-night serenade of the most dismal howling imaginable. Apropos of the possible reclamation of this animal from a wild state our author before quoted, Mr. John James Audubon, says: "Once when we were traveling on foot not far from the southern boundary of Kentucky, we fell in with a black wolf following a man with a rifle on his shoulder. On speaking with him about this animal, he assured us that it was as tame and gentle as any dog and that he had never met with any dog that could trail a deer better. We were so much struck with this account and with the noble appearance of the wolf that we offered him one hundred dollars for it; but the owner would not part with it for any price."

As contrasted with this animal we give a drawing of the coyote (*Canis latrans*) and a representation of its skull as compared with that of the black wolf. It is a member of the only other genus of wolves inhabiting North America.

J. CARTER BEARD.

Fast Wheeling.

A bicycle relay run between Indianapolis, Ind., and Columbus, O., a distance of a little less than 200 miles, was made at an average speed from start to finish of a mile in 3 minutes 27¼ seconds, or 17·35 miles per hour.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR BRAKE.—William F. Gibbs, Auburn, N. Y. This invention provides a simple form of brake mechanism especially designed for use on street cars, to afford the necessary power and occupy but little space. The brake shoes are suspended adjacent to the wheels, and pairs of levers on opposite sides have movable and connected fulcrums, adjustable rods connecting the lower ends of the levers with the brake shoes. While a crank shaft journaled beneath the car has disks at each end from which arms extend oppositely to the free ends of the levers. The mechanism is readily adjusted so that the shoes will always bear evenly upon both the front and rear wheels.

CAR WINDOW GUARD.—Edward B. Loomis, Memphis, Tenn. This is a dust and cinder protector of such simple construction that it can be carried in the pocket or valise of every passenger, and quickly and easily set up in position to serve its purpose as desired. It consists of a sectional folding stick having prongs at its ends, buttons on its face, and a hook and pin at its joint, in combination with a sectional folding deflector wing having keyhole-shaped apertures in each section and eyelets for protecting the apertures. The stick folds like a measuring rule and the deflector wing like a book.

Electrical.

COMPOSITE CONDUCTOR.—Charles A. Mezger, Brooklyn, N. Y. This conductor is composed of a series of conductor mediums that are tubular, a solid cylindric center conductor, with annular insulations interposed between adjacent conductors that are graded for length at the ends, the longest being central and all the ends externally threaded to engage with a composite coupling. The invention provides novel means for the branching of lateral conductors from main lines, producing angular variations from straight lines of conductor mediums, or coupling together two or more composite conductor sections and effectually insulating each conductor from an adjacent conductor.

LAMP OR CONDUCTOR SUPPORT.—Charles Bell, Stroudsburg, Pa. This device consists of an eyebolt or clip provided with a threaded shank and an insulator formed of two parts, having rectangular notches in the lower part for receiving the inwardly bent ends of the hanger, the upper portion having recesses which will permit of the removal of the hanger from the insulating support after the lower half has been let down by unscrewing the supporting nut. The clip is formed of two similar oppositely arranged arms connected by the pivot, the lower ends of the arms bent into a circular curve and cut away, so that they overlap each other, forming a complete eye when they are closed.

STOP MOTION FOR KNITTING MACHINES.—Albin Beyer, Brooklyn, N. Y. An electric circuit closer is, by this invention, attached to a revolving spool carrier and controls an electro-magnet, while a spring-pressed clutch pulley and brake mechanism are arranged on the main driving shaft of the knitting machine and controlled from the electro-magnets, the devices being arranged in such a manner that when the clutch is opened the brake is applied, and vice versa. There is also a thread compensating device arranged on a revoluble spool carrier and actuated shortly after the circuit closer has closed the circuit.

Mechanical.

LATH BOLTER.—John H. Peterson, Portland, Oregon. This is a machine of simple and durable construction, designed to be very effective in operation. It has live top rolls and two live bottom feed rolls in front of the saws, and one live spreader roll behind the saws, whereby the laths are prevented from throwing back cants after they have passed through the saws. By employing novel eccentric boxes lead can be given to the top feed roll, so as to hold square-edged lumber up hard against the guide.

FLUE STOPPER.—Joseph A. Brown, Riverhead, N. Y. This device consists of a body section to which bow springs are pivoted at right angles to each other, the springs being foldable down upon the body when not in use and carried upward to cross one another when required for service. When the device is forced into a flue opening the springs bind against its sides and effectually hold the body in position as a covering for the opening.

FLUE CLEANER.—Walter Pharr, Barnum, Texas. A hollow tubular stock open at both ends is mounted on a handle rod which is longitudinally movable and protrudes at one end, while its opposite end has spring arms flared at their outer ends, but compressed by the walls of the stock when drawn in. By holding the stock and pushing the handle rod forward the spring arms adjust and the cleaner head expands to fit the flue, being held in each position by a latch, but when the handle rod is drawn backward into the stock the spring arms are compressed. The head consists of segmental serrated sections and scraper sections held on the spring arms.

Mining, Etc.

ORE CONCENTRATOR.—H. F. Hicks, Ashland, Oregon. An open ended cylinder is, by this invention, provided with a series of internal flanges, which are highest in the middle of the cylinder and diminish in height toward the end, and a feed flume is arranged to deliver centrally within the cylinder. The construction is simple and economical, and this form of concentrator is especially adapted for separating the refractory metallic particles and sulphurets from the tailings of gold or silver extracting mills.

Agricultural.

GUIDE MARKER FOR CORN PLANTERS.—Herrman A. Behrns, Orchard, Iowa. This is a very simple and inexpensive device, which may be applied to any corn planter, and which may be quickly and conveniently shifted to mark either at the right or left of the implement, and it may also be further shifted so it will not touch the ground at either side, thus permitting the planter to be readily turned when desired.

Miscellaneous.

HOT AIR FURNACE.—John W. Frizzell, Brainerd, Minn. In the upper end of the casing is a hot air chamber, and in its lower end a cold air chamber, vertical pipes connecting the two chambers, between which is the fire pot, having a closed ash pit, there being a downward draught around the pipes and sides of the fire pot. The construction is such that the energy of the fuel is utilized to its fullest extent for heating the air, the draught being conveniently regulated to insure proper combustion, and there being also a damper to control the outlet for the smoke and gases.

STAINED WINDOW GLASS.—Arthur R. Carter and Henry C. Hughes, London, England. The improvements provided by this invention in the making of stained glass panels dispense with the usual leaden frames in which the pieces of glass have heretofore been fixed, and comprise the juxtaposing and welding together by heat of the contiguous edges of variously colored pieces of glass between thin sheets of platinum within a marginal frame, painting on the mosaic with vitrifiable enamel colors and again firing to fix the colors, then applying upon and welding by heat to the artistically treated surface a covering sheet of white glass. The welding of the component parts and of the mosaic to the covering is performed in an ordinary muffle.

DOOR HANGER.—August G. Dahmer, Alameda, Cal. This is an improvement in sliding door hangers, whereby the door may be readily raised or lowered as desired, a single track only being necessary for the hangers to slide on. The suspension frame has an inclined frame at its bottom, and a wedge block travels in engagement with the plane and the shoulder of the hanger, there being an adjusting screw to regulate the movement of the wedge block to raise and lower the suspension frame.

BOB SLED.—Robert Douglass, Tara, Canada. The kind of sleds used in logging are especially the object of this improvement, the sleds being thereby so connected that they may be quickly adjusted to hold them a desired distance apart, means being also provided to enable the sleds to be quickly backed or hauled to any desired position and to conform to the irregularities of the ground. The forward bob sled is swivelly connected with the rear bob sled, and the latter is flexibly connected with the reach, so that the sleds may be brought into almost any required position without straining them. A convenient means of binding the load to the sleds is also provided.

PIANO.—Anders Holmstrom, New York City. This improvement permits of shifting the key board and at the same time making proper connection between the fixed actions and the shifted keys. Combined with a key board having straight keys is a damper lever arranged out of alignment with the corresponding key, a bar pivoted to the lever permitting it to swing sidewise to bring the free end of the bar over the end of the corresponding key, means being provided for fastening the bar in place on the lever after it is adjusted relative to the key board.

SLIP HOLDER.—Samuel J. Kelso, Detroit, Mich. This is an improved device to hold salesmen's entry slips and similar articles, and consists of a case or holder which may be conveniently carried about, to receive entry slips, bills, etc., holding them so that they will not be scattered and in a manner to be easily written upon, either when the holder is in the hand or laid upon a support. The case is open-topped and has cross strips across its face, a spring-pressed follower pushing the slips outward, while side flanges of the holder embrace the top and bottom of the case.

LETTER BOX.—William H. Sheffield, Brooklyn, N. Y. For letter boxes such as are placed side by side and are usually packed into a small space, this invention provides a hinge by means of which the door of the box may be hung from the inside, so that the door may be very nicely finished without exposing the hinge, the hinge being so made that it will not strike the side partition of the box, while it will be very strong and will act as a brace when the door is open.

RUBBER SHOE.—Samuel W. Powell and John W. Marshall, Richmond, Mo. This shoe has at its heel a pocket open at its upper end, in which is held an elastic strip fastened at the base of the pocket, there being a fastening device on the upper end of the strip adapted to engage a button or projection on the shoe over which the rubber is worn, while the elastic strip is received within the pocket of the rubber when disengaged.

FOLDING BED.—Hugh Stevenson, New York City. Combined with a tilting bedstead mounted on a suitable base is a cable connected with the base, and means for tightening and loosening the cable by the movement of the bedstead, the several pieces of bedding being connected at one end to the cable, which separates and lowers the bedding with the rise and fall of the bed. By this improvement the covers and bed are freely suspended when the bedstead is folded, thus permitting a full circulation of air within the bed clothing instead of its being held tightly within the casing.

CLOTHES DRIER.—Hugh Stevenson, New York City. This is a convenient device which may be easily placed in position in a window to form a handy support for small clothes. It consists of a main bar adapted to be secured in a support, and having circular racks and horizontally swinging arms, readily adjustable as desired.

HAT HOLDER AND CASE.—Hugh Stevenson, New York City. This is an improvement in hat holders for carriages and other vehicles, a hinged receptacle being provided in which a stiff hat of any kind may be readily placed and securely held, a soft hat being carried in the case to be substituted for the stiff hat when desired. The case is secured to the roof of the carriage, from which it is swung open, being locked in place by a catch when swung upward.

HAT PACKING CASE.—Joseph S. Abrams and John Langsdorf, New York City. An elongated box, of which a lid forms one side wall, is provided with a series of spaced elastic carrier bows adapted to spread when a hat is inserted, forming a novel hat packing case for sample hats, holding them safely separated and protected from contact with the case walls, while affording ready access to any hat without disturbing the others. These cases are also adapted to be carried within an ordinary hat packing trunk, any case of the set being readily removed, as required, where the goods have to be exhibited.

HAT POLISHER AND CLEANER.—Cæsar Simis, Brooklyn, N. Y. This is a machine comprising preferably an electric motor and a rotary expansible hat holder or carrier, to fit within a wearer's hat and rotate it, the hat being thus firmly held and rapidly revolved, so that when a finishing cloth, brush, or iron, is held against the hat it will be quickly cleaned and polished. The improvement is primarily designed for use in stores, barber shops, etc., where the small amount of electric power needed may usually be readily obtained, and a boy may polish and clean a customer's hat while he is waiting.

BUCKLE.—Martin Logan, New York City. The two leading parts of this buckle—that is, its body and loop piece—are made to engage after the manner of a clasp, the buckle having a variety of features of novel construction, and being useful wherever a buckle can ordinarily be used for uniting two parts or pieces together, irrespective of what the parts are made of, such as woven fabric, cloth, or leather, etc.

SPONGE CUP.—James S. McClung, Pueblo, Col. This is a cup of simple and durable construction, to be readily applied to any form of school desk, it being so made that a sponge held in the cup may be dampened and the surplus water pressed out into a receptacle provided for such purpose. The support for the cup may also be used as a rack to hold pen holders, pencils, etc.

FILLING SYRINGES.—Lewis S. Riggs, Selma, Ala. This apparatus comprises a cork with a longitudinal opening enlarged at its inner end and having on the outer end a rib or bead surrounding the opening, in combination with a syringe having a bearing forming in connection with the bead a tight joint. The special cork and syringe are adapted for use together in filling the syringe from a bottle, an ordinary cork being kept in the bottle at other times.

BAR FIXTURE.—Alexander Brandon, New York City. This is an attaching device for the under side of a bar, a frame turning upon a depending bolt or rod, and receptacles being removably bolted to the outer edges of the frame. The receptacles may contain sugar or other articles, to be concealed beneath the bar when not in use. The construction is durable and inexpensive, and the receptacles are readily removed and replaced to facilitate cleaning.

ANIMAL TRAP.—Henry J. Steiner, Jersey City, N. J. This trap is adapted, when sprung, to strike the animal across the neck or back, and thus hold it a prisoner. The striking arm is controlled by a coiled spring, and the trap may be set from the exterior, it not being necessary to pass the hand into the inside for this purpose. The bait lever acts as a trip lever, and the construction is strong and durable.

DESIGN FOR A BOTTLE.—Leopold Kahn, New York City. This design has curved stem-like figures, from which extend side branches terminating in flower-like figures falling over and upon the bottle top, numerous leaf-like figures giving an appearance of open lace work. The design relates to that variety of bottles which are inclosed in a metallic covering.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE OPTICAL INDICATRIX, AND THE TRANSMISSION OF LIGHT IN CRYSTALS. By L. Fletcher. London: Henry Frowde. 1892. Pp. xii, 112. No index. Price $3.

This tract is a reprint from a mineralogical magazine. It treats the subject mathematically and will no doubt be found of value to physicists, especially to those interested in the laws of light.

BUSINESS LAW. By Alonzo R. Weed. Boston: D. C. Heath & Co. 1892. Pp. 172. Price $1.10.

This work purports to be a manual for schools and colleges and for everyday use. According to the preface, the rule of law that no one is excused because of his ignorance of the law is well established, and the knowledge of some of it is here presented. The work is very attractively printed with full-faced captions, and one section of it is devoted to questions and exercises in the subjects treated. A very satisfactory index is appended.

THE ATLANTIC FERRY: ITS SHIPS, MEN, AND WORKING. By Arthur J. Maginnis. London: Whittaker & Co. New York: Macmillan & Co. 1892. Pp. xviii, 304. Price $2.

With its numerous illustrations of old-time ships, as well as of the more modern productions of the naval architect, with a record of their achievements and portraits and notes of the lives of the men identified with the great business of ocean lines, this work will be found thoroughly popular. The reprints of early advertisements and the collection of every kind of record, the numerous tables, such as those of average passages, causes of loss, and the list of records and events up to a very recent date, give the work a statistical value hard to overrate.

THE LOCOMOTIVE. VOL. XII. The Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn. Pp. 194.

Considerable interesting matter accumulates in the pages of this little periodical from year to year. We believe that the present volume, which we are glad to see is provided with an index, will be of use as well as of interest. The lesson taught by it is, emphatically, greater care of our steam plant and boilers.

GENESIS I. AND MODERN SCIENCE. By Charles B. Warring, Ph.D. New York: Hunt & Eaton. Cincinnati: Cranston & Stowe. 1892. Pp. 245. No index. Price $1.

Whether there is any use in discussing the supposed conflict between modern science and the Bible is a very open question. The author of the present work at all events has had the satisfaction of pointing out the changes of base taken by scientists, showing to that extent their unreliability as exponents of positive truth in all matters.

A GERMAN SCIENCE READER. By J. Howard Gore. Boston: D. C. Heath & Co. 1891. Pp. ix, 185. Price 80 cents.

The effort to add interest to the study of a language by combining science therewith is the motive of this reader. With quite full notes and a very satisfactory vocabulary and with the separate reading lessons, each referred to its author, the work seems to possess an unusual value. While the absence of index is noted, it is of course a class of book which really requires none.

DIE ELEKTRICITAT. Von Th. Schwartze, E. Japing und A. Wilke. Wien, Pesth, Leipzig: A. Hartleben. 1892. Pp. 157. Price 50 cents.

In this short work, which is the fourth edition, the entire subject of electricity is in some shape covered. It contains a number of illustrations, has an index, and altogether is of quite a practical nature.

FARMYARD MANURE. By C. M. Aikman. William Blackwood & Sons, Edinburgh and London. 1892. Pp. xiii, 65. No index. Price 60 cents.

This short and practical work will be of considerable value to the farmer as giving him the modern view of the all-important question of the fertility of his fields. It gives a comparison between natural and artificial fertilizers and the best methods of dealing with the former.

SILK DYEING, PRINTING, AND FINISHING. By George H. Hurst. London and New York: George Bell & Sons. 1892. Pp. viii, 226, with additional pages giving samples of dyeing. Price $2.

The practical description of the dyer's work and the production of all kinds of colors on silk are the matter of this volume, the beautiful samples appended seem to be the best recommendation of the work, as indicating what may be done by following its precepts.

LE GAZ, ET SES APPLICATIONS. E. De Mont-Serrat et E. Brisac. Paris: J. B. Bailliere et Fils. 1892. Pp. 366. No index. Price 80 cents.

The history, technology and different applications of gas and its by-products are all somewhat briefly treated in this work. In some respects, such as its summary of the photometry of gas, it will be found of decided value.

EXPERIMENTS WITH ALTERNATE CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY. By Nikola Tesla. New York: The W. J. Johnson Company, Limited. 1892. Pp. ix, 146. No index. Price $1.

This book is a reprint of a lecture delivered before the Institution of Electrical Engineers in London, preceded by a brief biography of the author. The illustrations, which are engravings, are rather a relief after some of the reproductions of Tesla's work which have hitherto been published. A portrait of the author, with facsimile of his autograph, serves as frontispiece.

BLOWPIPE ANALYSIS. By J. Landauer. Authorized English edition. By James Taylor. London and New York: Macmillan & Co. 1892. Pp. xiv. Price $1.75.

The compactness of this work and its tabular statements of blowpipe work and systematic causes of analysis will give it a place in the scientific field. The author adopts the aluminum plate which was so strongly advocated by Ross, and the more recent refinements of the work naturally find a place in it.

MANUAL OF SCREW CUTTING. By William Simpson. Boston: S. Woodberry & Co. 1892. Pp. 40. No index. Price 30 cents.

The value of this very brief manual seems to be attested to by the fact that this is the fifth edition, and its practical precepts will assure it a further acceptance by the public.

THEORIE DU NAVIRE. Par J. Pollard et A. Dubebout. Tome III. Paris: Gauthier Villars et Fils. 1892. Pp. i, 523. No index.

This third volume of the exhaustive treatise on naval architecture is devoted to the mathematics of the subject, especially as regards wave motion and the resistance of the water to the propulsion of the ships. The differential calculus is used as required and the subject is treated with every refinement of analysis. The paper and printing are beyond all criticism, the reproduction being in a mechanical sense a most elegant example of the publisher's art.

THEORETICAL MECHANICS. By J. Spencer. London: Percival & Co. 1892. Pp. viii, 243. No index. Price 80 cents.

This is a class book for the elementary stage of the English Science and Art Department. Being written for a limited and sharply defined field, its scope appears somewhat contracted. It is well printed and illustrated, however, and naturally possesses a value of its own.

LE POIL DES ANIMAUX ET LES FOURRURES. Lacroix-Danliad. Paris: J. B. Bailliere et Fils. 1892. Pp. 419. No index. Price 80 cents.

An excellent illustration of the thorough French treatment of a subject as afforded by this book, which is really a monograph, and which treats of furs and skins of animals from every point of view. It is especially commendable from the illustrations, which in their sketchy French style are peculiarly effective. Many of them refer to the animals themselves and make a most attractive portion of the work.

The Californian Illustrated Magazine for July has over a hundred pages of excellent reading matter, and many attractive illustrations. Most noticeable of the general articles is one on "The Florence of the English Poets," and one on "Pompeii," with many recent photographs. First in interest, however, is a paper entitled "In the Yosemite," illustrated from paintings and photographs, while the descriptions of the Pasadena Southern California Mountain Railroad and the Schools of San Francisco, both amply illustrated, also contribute to the making of a highly interesting number. The magazine is published by the Californian Publishing Company, San Francisco. Price $3 a year.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4451) F. W. D. asks: The relative durability of yellow poplar, white pine and hemlock, used as lap siding, also how long can yellow poplar be exposed to the weather before it commences to decay? A. White pine is the best for building purposes under all conditions and for siding is far superior to poplar or hemlock, which curls and disintegrates by exposure to the weather, and will decay by the action of moist air much quicker than pine.

(4452) R. N. C., being an amateur photographer, asks advice in regard to whether he shall sell his prints. A. If you take photographs for the love of the thing or, in other words, if you are an amateur, do not commence to bother for the results of your work. If friends particularly want copies, and you cannot afford to give them away, lend your negative to some struggling professional in your neighborhood, and refer them to him. You will thus be helping the profession without doing anything to interfere with it or injure it in any way.

(4453) J. L. W. asks: 1. Would an iron rod connected with the iron cresting on peak of a house and carried into the ground protect a house from lightning? A. A lightning rod erected in the manner proposed and merely inserted in a hole in the ground would be worse than nothing, but if you were to dig a trench in earth that is constantly moist, put in a layer of coke and then lay your rod along the coke bed for 5 or 8 feet, cover the rod with coke and fill up the trench, you would have a lightning rod that would be serviceable. 2. Would it hurt a boiler to allow the steam to blow out all the water and sediment after the fire was drawn? A. It depends something upon the construction of the boiler. If the boiler were one in which rapid cooling would cause irregular expansion and consequent severe strain, of course it would be injured by the treatment suggested.

(4454) F. A. L. asks how the storage batteries which I see moved about as dry batteries are made so they can be handled so, and if they could be recharged from gravity batteries? A. Storage batteries can be readily moved about after the electrolytic liquid is removed. After they are put in place the same liquid or a liquid of the same specific gravity should be placed in the cells. We know of no dry secondary battery.

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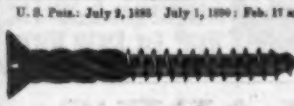

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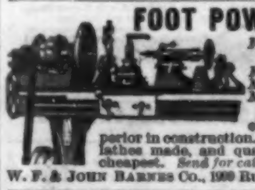

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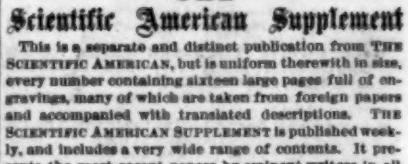

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